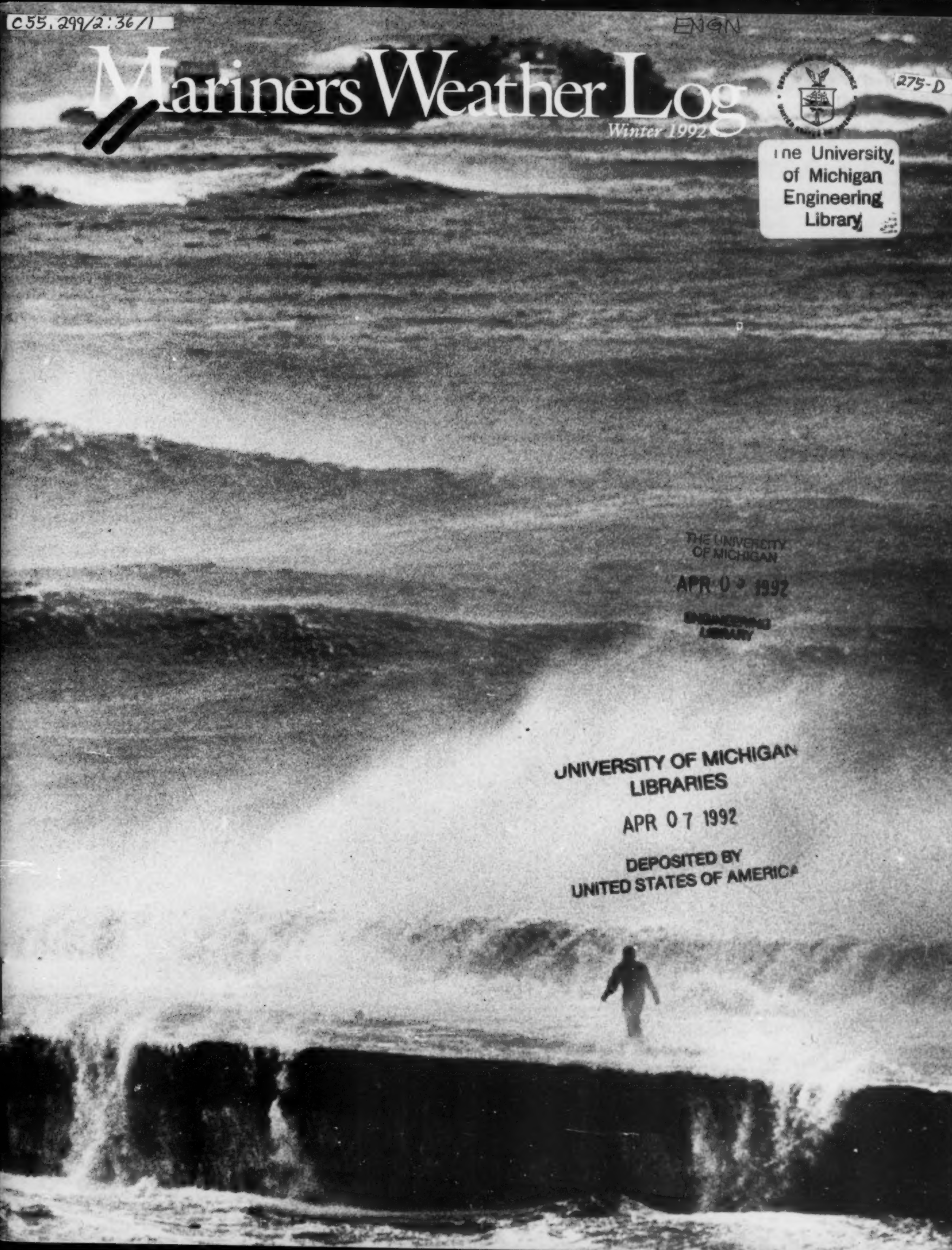
Mariners Weather Log

Winter 1992



Isle Royal Lighthouse

Lake Superior

Menagerie Island

Pen and ink drawing by Leo Kuschel

Descriptive passage by Leo and Sue Kuschel

On the northeast end of Menagerie Island, the Isle Royale Lightstation marks the entrance into Siskiwit Bay, a major harbor on Isle Royale. In Spring 1874, construction of this light began and on September 20, 1875, the light was lit. The red sandstone tower has walls 40 inches thick at the base tapering to 10 inches at the top. Its ten–sided cast iron lantern holds a fourth order Fresnel lens. The 61–foot octagonal tower is connected with an 8–foot long passageway to the keepers dwelling also made of red sandstone.

Story has it that one of the workers helping to build this light was so taken with the country that he asked to stay on as the keeper. Finding out he must be married to get the job, he married within 2 weeks and spent most of his life at the station. It must have been a happy life for he and his wife produced 12 children. They named all of them after Lighthouse Service district inspectors, thus insuring his keeping the job he loved so much. In fact, the year his wife bore twins there happened to be two district inspectors! What a happy circumstance.

Historical Society of Michigan
2117 Washtenaw Av.
Ann Arbor, MI 48104

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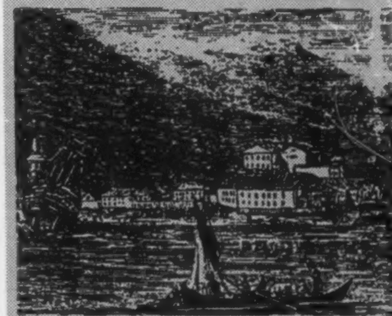
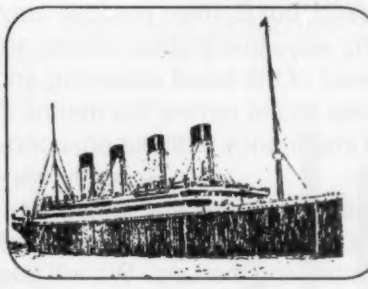


Baranov's Castle also served as Alaska's first light in 1805— Page 26.

Halloween took on a new meaning to U.S. East Coast residents. See page 4.



The Titanic and two of its memorials. Story on pages 18 and 21.

Cover: A man braves the Halloween Storm's crashing surf while crossing the causeway to Marblehead Neck, Massachusetts. At the top of the page is Tinkers Island. Globe Staff Photo by Michelle McDonald and courtesy of the Boston Globe.

Back Cover: Not everyone viewed the Halloween Storm as a downer. From Maine to Florida, the surf was phenomenal for those who live for such things, like Peter Jenkins off Revere Beach, Massachusetts. Photo by David L. Ryan, Staff Photographer, Boston Globe.

Centerfold: East Coast Lighthouses took a beating this year from Bob and the Halloween Storm. This vivid photograph of the Cape Hatteras Lighthouse by Gene Furr is a scene we are not likely to see again.

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Marine Weather Review

July, August and September 1991

Mariners Weather Log

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The Secretary of Commerce has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through July 1, 1992.

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National Oceanographic Data Center

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Our 35th Anniversary

We have just finished our 35th year of publication. This anniversary provides an opportunity to thank some people who rarely get mentioned, and to reiterate the purpose of the Mariners Weather Log for our newer readers.

Behind the scenes, the Mariners Weather Log has endured some tribulations through the years, first in getting started and then remaining viable. Several people have championed our publication. Four who readily come to mind are Bill Haggard, Art Cooperman, Bob Lockerman and Vince Zegowitz. These guys have fought some tough battles on behalf of the Mariners Weather Log, and it is through their efforts that we have as fine a product as we do today. This special thanks is long overdue.

The Mariners Weather Log was established in 1957 as a communication link between the **voluntary** weather observers aboard ship and the Weather Bureau. Their weather and oceanographic observations have represented a savings to the U.S. and others that total in the millions of dollars. There is also an untold savings in lives, as observations are factored into tropical cyclone and other severe weather warnings of a marine nature. Over the years the Weather Bureau has evolved into NOAA and mariners are taking more than just weather observations. In addition, the U.S. Navy and Coast Guard observations as well as those from buoys and satellites have become crucial. The Log has also evolved, but its main purpose stays the same— to show the many ways these observations are used, to keep the mariner abreast of the latest observing and communications techniques and to remind the marine community of the availability and importance of these environmental data from the world's seas.

Recently, we completed our annual purge card survey and asked for comments. The results were gratifying, and there were many excellent suggestions for improving the Log. We will take these to heart and, keeping in mind the purpose of the Log, will strive to make it an even better publication in the future. One of the things that we are excited about this year is a series on NOAA's Marine Sanctuary program. These sanctuaries have been called the National Parks of the sea, but are much more than that, and are important to mariners and marine enthusiasts alike. We would once again like to thank the merchant mariner for his time and effort in providing quality weather observations, and the PMOs for their dedication to the VOS program.

Rating Northeasters

Robert Dolan and Robert E. Davis

Robert Dolan and Robert E. Davis work for the Department of Environmental Sciences, University of Virginia in Charlottesville, VA 22903. Their fine article was based upon research sponsored by the NOAA Office of Strategic Analysis: Grant No. NA170A0040-01.

Hurricane Bob roared up the East Coast of the United States in August of 1991 causing an estimated 18 deaths and $1.5 billion dollars damage. Some 2 months later the East Coast was the scene of another potent system—an unnamed E.T. (extratropical storm), which has become known as the *Halloween Storm*. This storm may have caused more damage than Bob.

Although hurricanes have caused billions of dollars of damage and hundreds of deaths along the U.S. Atlantic Coast, less powerful E.T.s, also known as winter storms, or northeasters, take their toll each year on ships, beaches and coastal developments.

Severe northeasters have always been a hazard for mariners sailing the Atlantic Coast. The

Dune Road in Westhampton, Long Island (New York) could be renamed Duneless Road after the Halloween Storm of 1991 battered more than two dozen beach-front homes into piles of debris (left). Dozens more on the bay side were flooded or partly buried by sand in what officials called the worst storm damage in 20 years. Two separate areas of the barrier beach were breached by the ocean. This area was recently hit by Hurricane Bob, but the tides of the Halloween Storm were higher. In other areas, a large portion of Fire Island had to be evacuated. Off Fire Island, four fishermen were rescued after their boat capsized. Several other boats in the region sank and an Air National Guard helicopter from Westhampton had to ditch after an unsuccessful rescue mission. Four of the five crewmen were rescued, but one was not found. At Montauk Point 10 feet of bluff on each side of the Montauk Lighthouse was carved out. In Nassau County mainland communities including Seaford, Bellmore and East Rockaway experienced serious flooding during the periods of high tide. Photograph reprinted courtesy of **Newsday**/*John H. Cornell Jr.*

waters off Cape Hatteras, North Carolina, have become known as the *Graveyard of the Atlantic* due to the loss of hundreds of ships, mostly driven aground or sunk when severe coastal storms developed rapidly or unexpectedly. A recent example of the danger caused by a sudden storm occurred in October 1990 at Oregon Inlet, North Carolina. Strong winds and high waves drove the hopper dredge ***Northerly Island*** into Bonner Bridge, severing the link between Cape Hatteras and the mainland of North Carolina for over 4 months (Mariner's Weather Log: April 1991).

Atlantic Coast residents are naturally prone to compare the destructive power of storms. Some claim that a 1989 storm was responsible for more damage and beach erosion than the *Ash Wednesday Storm of 1962*, while others maintain that the great 1962 northeaster was more destructive.

Perceptions of a storm's magnitude often will differ based on ones experience of a storm's damage in the immediate area. This isn't the best way to compare storms. Local damage can be affected by factors not necessarily related to the storm's atmospheric or oceanographic characteristics.

The Saffir-Simpson Scale has been used for the past 20 years to compare tropical storms and hurricanes. This scale ranks hurricanes into five classes based on their maximum wind speeds. Northeasters, on the other hand, are not as clearly defined as hurricanes; their wind speeds seldom approach hurricane strength. E.T.'s are, however, usually much larger than hurricanes and generally move more slowly. Northeasters, which routinely spend several days along the Atlantic Coast, often generate wave heights that equal or exceed those of their tropical counterparts. In 1969, the storm that formed in the Gulf of Mexico on St. Valentines Day (February 14) didn't reach its peak until the 25th, near 44°N, 38°W. In March 1962, the U.S. East Coast was under a battering from the *Ash Wednesday Storm* for about 5 days..

The Dolan/Davis Scale

The classification of Atlantic Coast winter storms offered here is based on measurements of storm locations, tracks, fetches, durations, and wave heights. Our data consist of 1347 northeast storms, spanning the period 1942 to 1984. Using weather maps, we tracked these storms along the Atlantic Coast and hindcasted the significant wave heights generated by each storm for fetch areas off the North Carolina coast. We used the 5-foot (1.3 meter) minimum significant wave height as the threshold for our definition of a northeast storm based on confirmed field evidence that a 5-foot (1.3 meter) deep-water significant wave height will result in measurable beach-face erosion along the North Carolina coast. Whenever possible, we verified our wave height and duration data through comparisons with measured wave records obtained from NOAA buoys positioned in the fetch areas. Using a measure of relative storm power (significant wave height and duration) for each of the 1347 storms as the classification variable, we grouped the data into classes using cluster analysis.

The Five Storm Classes

Weak (Class 1) systems account for almost 50% of the storms included in our data set. These weak systems generate significant wave heights of 2.0 meters and have an average duration of 8 hours. **Moderate** (Class 2) category storms have sig-

Dolan/Davis Storm Classes and Coastal Impact

Storm Class	Beach Erosion	Dune Erosion	Overwash	Property Damage
Class 1 (Weak)	Minor Changes	None	No	No
Class 2 (Moderate)	Modest: mostly to lower beach	Minor	No	Modest
Class 3 (Significant)	Erosion: extends across beach	Can be significant	No	Loss of many structures at local scale
Class 4 (Severe)	Severe beach erosion and recession	Severe dune erosion or destruction	On low profile beaches	Loss of structures at community scale
Class 5 (Extreme)	Extreme beach erosion	Dunes destroyed over extensive areas	Massive in sheets and channels	Extensive regional scale: millions of dollars

The February 1973 Monster of the Month brought heavy snow as well as waves and winds to portions of the southeastern U.S. In South Carolina where snow is rare, up to 20 inches was reported in some areas. North Carolina reported up to 13 inches and Norfolk Regional Airport was blitzed (left). Photo courtesy of Virginian-Pilot.

Virginian-Pilot

nificant wave heights of 8.2 feet (2.5 meters) and an average duration of 18 hours. **Significant** (Class 3) storms have an average significant wave height of 10.8 feet (3.3 meters) and an average duration of 34 hours. Class 3 and higher storms can cause extensive damage to coastal structures and serious beach erosion. Of the remaining 3% of the storms, 2.4% are **Severe** northeasters (Class 4). These storms have longer durations, 63 hours, and generate average significant wave heights of 16.4 feet (5 meters). The duration of these Severe storms ensures that their high waves will bracket several tidal cycles. **Extreme** (Class 5) northeasters, are very powerful and rare. In the 42-year period of this study, only seven storms reached extreme intensity. The deep water significant wave height of Class 5 storms averages 23 feet (7.0 meters), and their duration averages 96 hours.

Storm Season

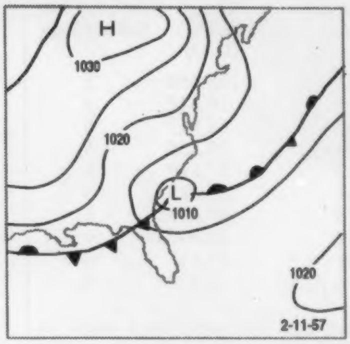
The monthly storm frequencies clearly indicate that most Atlantic northeasters occur from December through April, with a minimum between June and August. This is consistent with the seasonal migration of the polar front, a feature responsible for the formation and track of mid-latitude storms. Weak, moderate and significant storms are frequent in most of these months, while the severe ones are most likely in October and January (six storms each), with a secondary maximum in March (five cases). Of the seven extreme storms, five occurred during January, February and March; the other two came to life in October.

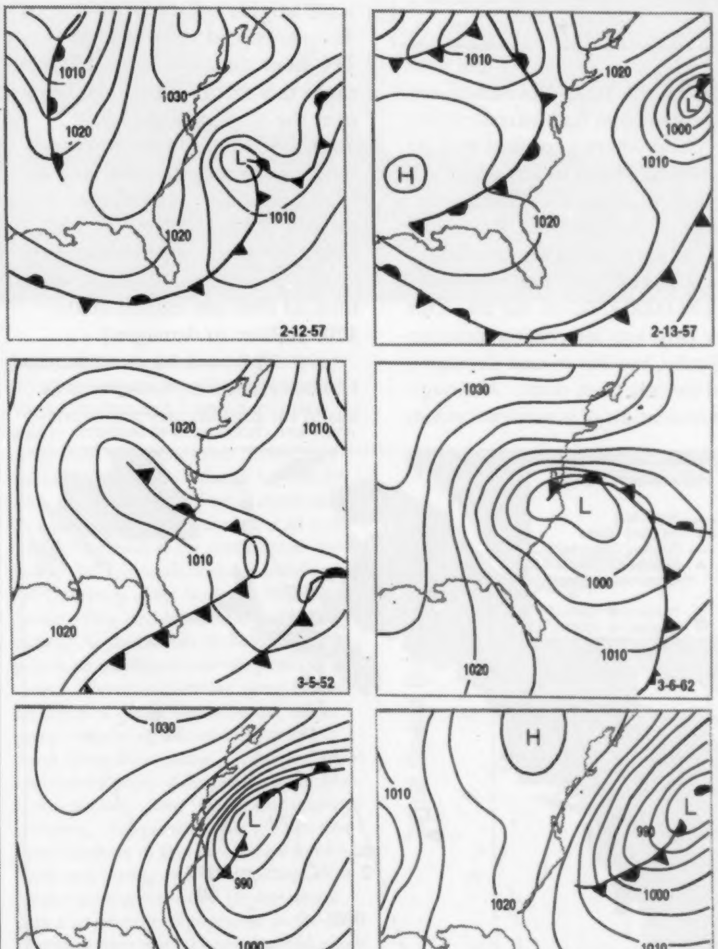
One of the top 10 storms hit Norfolk, VA in February of 1973. One of the oldest hotels in the popular summer resort of Nags Head, North Carolina was completely destroyed (left). Offshore the ***Esso Huntington*** *reported 60-knot winds in 33-foot swells. The* ***Seatrain Delaware*** *returned to Charleston, South Carolina on the 13th after encountering heavy weather enroute to San Juan and losing 16 containers overboard. Photo courtesy of the Virginian-Pilot.*

Virginian-Pilot

Favorite Areas of Formation for Severe and Extreme Extratropical Coastal Storms

Most of the severe and extreme Atlantic Coast E.T.s are spawned north of Cuba or over the Florida Peninsula. Storms generated north of Cuba track slowly northward intensifying over the open ocean, while the Florida peninsula storms intensify over the Gulf Stream and tend to travel north northeastward. The first three charts show the formation of a typical Class 4 or 5 coastal storm near the Florida Peninsula. The last four charts show a Class 4 or 5 storm forming north of the Bahamas.





Return of a Northeaster

We plotted the *relative wave power index* (H^2D; where H=wave height in feet and D=duration in hours) of each storm versus frequency in order to develop return intervals for each class. The average return interval of a Class 1 storm is about 3 days, while a strong Class 1 or a weak Class 2 storm occurs about once every 12 days. Class 2 northeasters occur about once per month on the average, while significant storms have a return interval of 9 months. The average severe storm occurs once every 11.3 years; 22 occurred over our 42-year study period. The return interval for our average extreme northeaster is over 100 years, but of the seven storms identified in Class 5, six had relative power values below the mean. One storm, in 1969, that had a particularly long duration resulted in an extreme power index. Excluding this storm, the average return period for Class 5 storms is 67 years.

Halloween Storm of 1991

The October 1991 storm was classified as an extreme northeaster (Class 5), and caused widespread damage and destruction along the entire East Coast of the United States and as far south as the Caribbean, and as far north as Nova Scotia.

This storm began on Monday morning, October 28, as a cold front moved across New England and the mid-Atlantic states and stalled a few hundred miles offshore. Surface analyses indicated that the Low was initially located a few hundred miles east of Nova Scotia. With a strong high pressure system (1045 millibars) located east of Hudson Bay, a substantial pressure gradient developed, producing moderate northerly winds and waves. Simultaneously, hurricane Grace was passing west of

The Top 10
(1943–1984)

Rank	Date	Significant Wave Height (ft)	Duration (hr)	Power Index (H^2D)	Dolan/Davis Storm Class
1	2/16/69	24.93	170	105,656	5
2	10/14/51	18.37	150	50,618	5
3	2/9/73	22.96	89	46,917	5
4	3/7/62	29.85	44	39,205	5
5	3/1/80	24.60	62	37,519	5
6	10/22/82	23.62	64	35,675	5
7	1/30/60	17.05	95	27,617	5
8	10/26/70	17.05	81	23,547	4
9	5/25/72	17.05	81	23,547	4
10	10/28/69	13.45	126	22,794	4

This list represents the 10 most powerful northeasters in the Dolan/Davis study. In computing the Power Index, H is the wave height in feet, while D is the duration of that wave height in hours.

Bermuda and traveling north–northeastward.

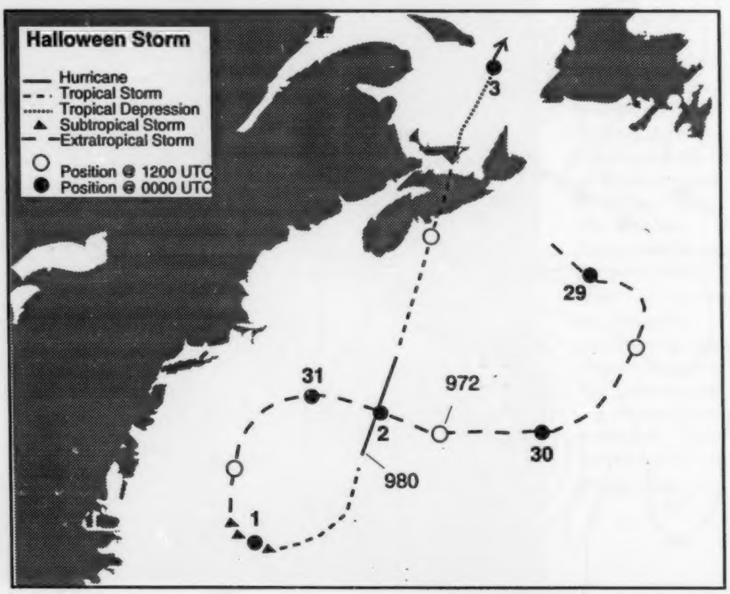
The Low continued to strengthen while moving southeastward then southwestward. Early on the 30th, Hurricane Grace merged with the Low adding its energy to the existing storm. The Low reached peak intensity at 1200 on the 30th some 340 nautical miles south of Halifax, Nova Scotia. At this time its central pressure had dipped to 972 mb with estimated maximum winds of 60 knots. With the High remaining strong north of Maine and the front moving southward through South Carolina a tremendous 1,000 nautical mile fetch developed from Newfoundland to Florida. Sustained winds persisted for 48 hours generating phenomenal seas and storm surges that rode in on high tides to cause considerable damage along the entire U.S. East Coast.

After reaching peak intensity as an E.T, the Low turned southwestward then southward and weakened. However, this motion brought it over a portion of the Gulf Stream where sea surface temperatures were near 26°C. Convection increased and by 1800 on the 31st the Low was acquiring subtropical characteristics. By 0000 UTC on the 1st of November, central convection had increased to the point where a tropical cyclone of tropical storm intensity could be identified within the central area of the Low. An Air Force Reserve Unit aircraft indicated that the storm was of hurricane intensity before 0000 UTC on the 2d. This new twist was interesting meteorologically, but the coastal damage had already been done. Although the formation of a tropical cyclone in the center of a non-tropical Low is rather unusual, it is not unprecedented. The tropical cyclone accelerated northeastward and made landfall as a rapidly weakening tropical storm near Halifax, Nova Scotia around 1400 UTC on the 2d of November.

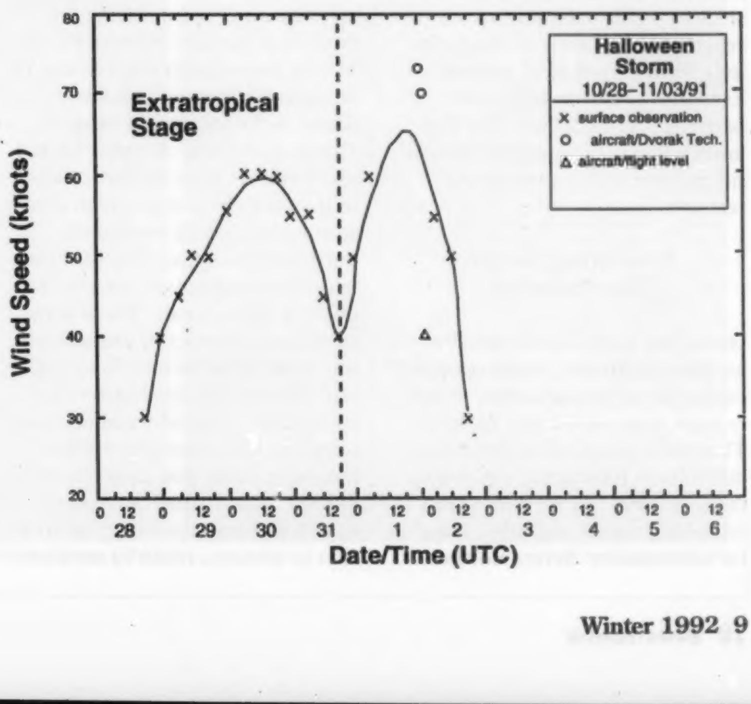
Preliminary Findings

Preliminary wave hindcasts for Cape Hatteras, North Carolina show significant deep-water wave heights for the Halloween Storm of 37 feet and wave periods of 18 seconds on October 30 and 31. These wave heights are the highest in our 42-year record. The storm's 114-hour duration (almost 5 days) ranks this storm as the sixth longest over the 42-year period, but according to the storm's value on our power index, it is the largest Class 5 storm on record, surpassing the *Ash Wednesday Storm* of 1962. (This year is the 30th anniversary of that great Atlantic storm, which took 33 lives and caused about $200 million in damages.)

The wave hindcast for the Halloween Storm, however, was based on preliminary and some-



Rodanthe Pier on the Outer Banks (page 10) along with dozens of beach cottages in North Carolina and Virginia were damaged or destroyed by wave action and storm surge; miles of highway were flooded and overwashed with sand deposits up to 6 feet thick, and beaches and frontal dunes along the barrier islands were eroded. Left is the preliminary track of the extratropical portion of the Halloween Storm of October 1991, courtesy of the National Hurricane Center. They also provided a preliminary chart of the fluctuation of the estimated maximum windspeed over the period of the storm. Waves wash ashore along Nantasket Beach in Hull, Massachusetts, where rising tides cut off several sections of the South Shore town (above). Hull is a resort town on the point of the peninsula in Massachusetts Bay, about 9 miles east southeast of Boston. The outer reaches of Cape Cod–from Chatham to Providence were hard hit. Their east-facing and north-facing ocean beaches were devoured by 15-foot waves atop a storm surge that peaked on the late afternoon high tide. The photograph above was taken by Tom Herde and provided by the Boston Globe.



Michael Halminski

what limited windspeed data and will require ground-truth verification from gauges. Initial reports from the U.S. Army Corps of Engineers research pier, located at Duck, North Carolina, indicate that shallow-water wave heights reached 15 feet with an unusually long wave period of 23 seconds. Estimates of storm surge were between 3 and 4.5 feet. The Halloween Storm certainly will be considered one of the strongest in recent memory.

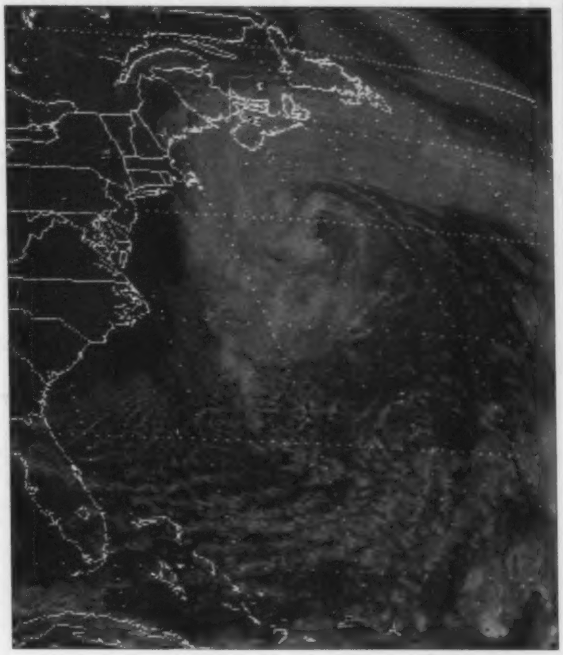
Predicting Severe Northeasters

One of the latest Northeasters to hit the mid Atlantic States occurred on the 4th of January 1992. Weather Service meteorologist Valerie Thompson when asked about the difficulty in forecasting rapid deepening replied: " ... we have to rely on fishing vessels and other ships" for information. Severe northeasters, such as the Halloween Storm, are as difficult to forecast as hurricanes; however, two common characteristics have been attributed to the development of Class 4 and 5 storms. First, severe and extreme storms mostly occur during the months of January, February and March; the majority form in one of two specific areas of cyclogenesis found in the subtropics between Florida and Cuba. Second, Class 4 and 5 storms, typically, are blocked to the north by a strong high pressure system, which slows their northward progress, thus resulting in the development of long fetches over the open ocean. These common characteristics of storm formation allow us to identify time periods when strong northeasters are most likely. This information, coupled with the numerical weather forecast models that currently predict the location and intensity of storms with some accuracy up to 5 days in advance, could be used to develop a coastal storm watch/warning system, which would be based on forecasts and climatological information. This accentuates the further need for accurate ship and buoy observations in the Atlantic to prevent errors in model forecasts of coastal storms.

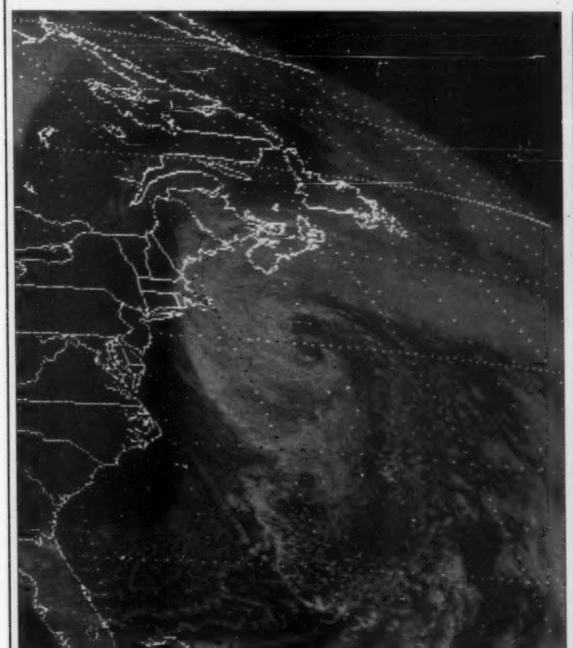
This new northeast storm classification should have practical value. It is simple to compute the relative power of a given storm by keeping track of the number of hours in which waves remain above 5 feet (1.6 meters). This categorization of a storm can take place on a real-time basis, similar to the Saffir-Simpson hurricane intensity scale. The information would be invaluable to mariners, coastal residents and emergency managers, who would be able to take necessary precautions with the approach of a severe or extreme northeaster.

Trick or Treat 1991

The Halloween Storm of 1991 will be long-remembered by East Coast residents. Ships and satellites played an important role in enabling forecasters to accurately track the storm and issue timely warnings. By 1431 UTC (right) the system had already reached its peak. At 1200 UTC the central pressure was about 972 mb and maximum sustained winds were estimaed at 60 knots. A few hours later (1730 UTC, below) the circulation still looks tight, although the central pressure rising. The satellite photograph at 1633 on the 31st (below, right) was taken just before the storm was deemed to be subtropical by the National Hurricane Center. At this time the pressure was about 996 mb and maximum sustained winds were at 40 knots. Its next transformation was to a tropical storm, which occurred by about 0600 on the 1st of November.



Satellite Services Division



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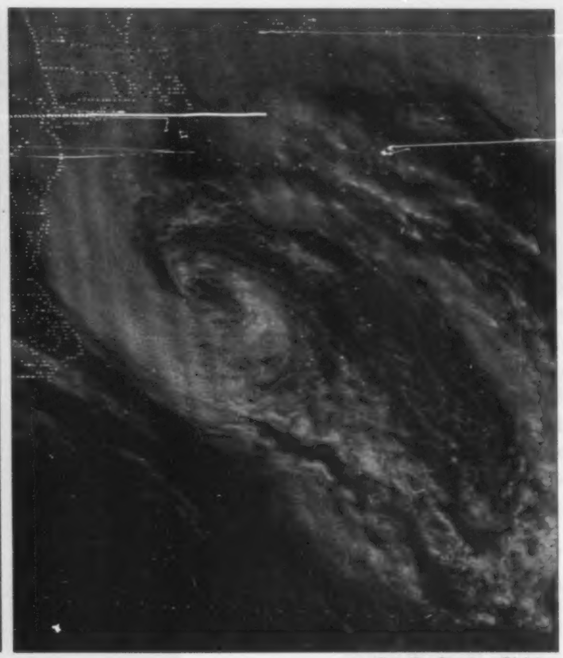


Satellite Services Division

A summer box office hit and a summer tropical cyclone smash shared a common name.

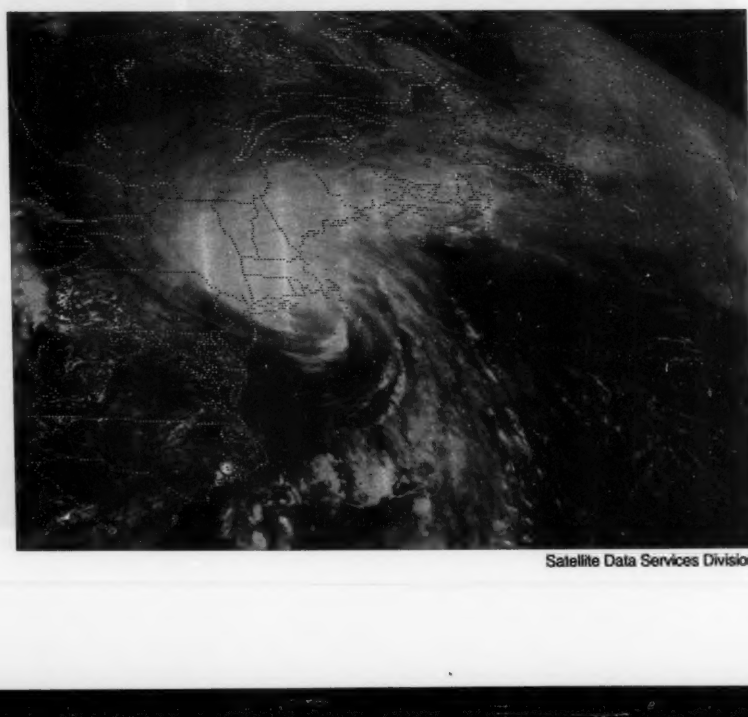
CENTRE

WHAT ABOUT (HURRICANE) BOB?

VICTOR MORRIS

The second Atlantic storm of 1991 developed rapidly near the Bahamas in mid August. Only 3 days later a major hurricane howled past Hatteras before slashing across southeastern Massachusetts and Maine. In its path Bob caused $1.5 billion worth of damage and 18 deaths. Marine preparations for the hurricane were often too little and too late.

Victor Morris is a professor of Aeronautical Science at Embry-Riddle Aeronautical University. He is also a consulting meteorologist.



Satellite Data Services Division

Bob was the first hurricane to strike New England since Hurricane Gloria in 1985. Although the National Hurricane Center provided a full 24 hours of hurricane warnings, many tourists paid little attention to them until core hurricane effects arrived. Due to the very long interval since the last mid season hurricane, most summer visitors lacked hurricane experience.

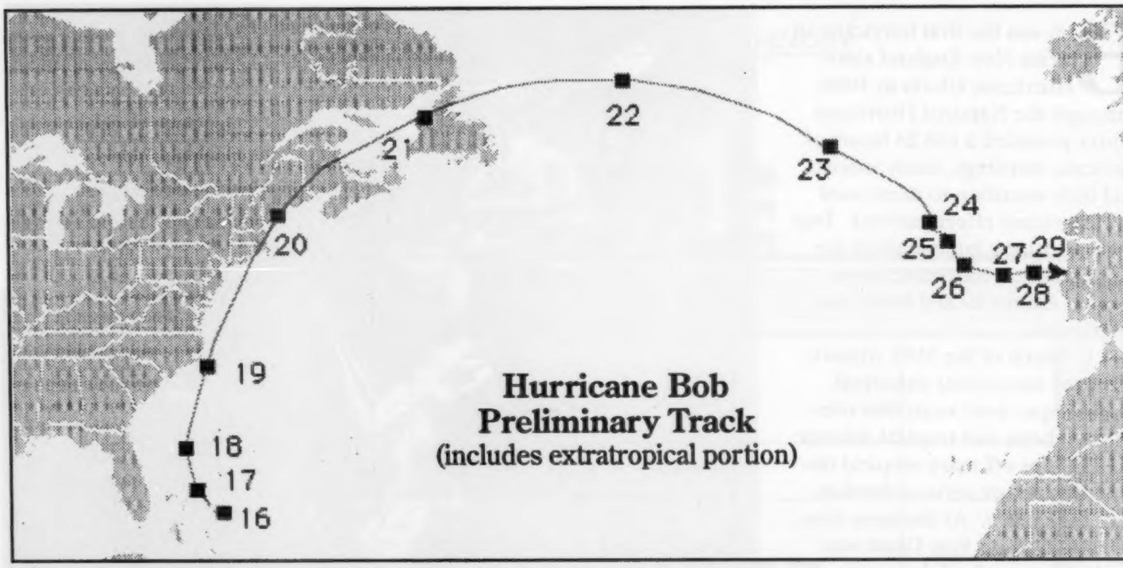
Much of the 1991 Atlantic hurricane season was abnormal. Strong upper level westerlies over the Caribbean and tropical Atlantic tore the tops off many tropical disturbances before serious development took place. At the same time the United States East Coast was very hot for much of the spring and summer, which allowed unusual heating of coastal waters. The minimum sea surface temperature favorable for hurricane development is 80°F, and readings this high were reported in the Gulf Stream, between 36° and 39°N, at times during July and August. Coastal waters ranged 2°to 5°F above normal from Massachusetts to Virginia. The warm water favored hurricanes in two ways. It allowed the process of tropical storm formation to begin at higher than normal latitudes and, once a storm formed, the warm water permitted it to retain hurricane strength well into the middle latitudes.

The disturbance igniting Bob was a cold front that moved off the New England coast during the first week of August. As the front dissipated near Bermuda, a loosely organized area of thunderstorms persisted near 30°N, 59°W. Upper level high pressure built west of Bermuda by August 11, forcing the thunderstorms to track southwestward. The storms continued west southwestward to westward during the next 72 hours with no significant strengthening. The high latitude of the initial disturbance and the long pre-storm phase likely contributed to complacency as the August 12–16 work week ended.

Steve Heaslip

Ropes Beach (Cotuit, Massachusetts) is strewn with boats that broke loose from their moorings (photo courtesy of Cape Cod Times). The satellite shot of Bob was taken at 1630 UTC on the 19th. Data for the preliminary track of Bob was provided by the National Hurricane Center and digitized by Gary Keull. The barograph trace (page 14) is from the NOAA ship **Rude** *at Fall River Massachusetts and indicates a minimum of 964 mb at about 1830 UTC on the 19th.*

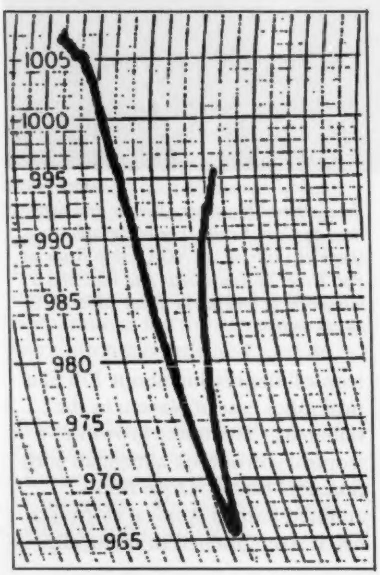
Early on the morning of August 16, a U.S. Air Force Reserve unit found a small tropical depression about 175 nautical miles east of Nassau in the Bahamas. The initial growth to a tropical storm took almost an additional 24 hours. Once Bob attained named tropical storm status, it strengthened dramatically.



Hurricane Bob Preliminary Track (includes extratropical portion)

The young storm quickly became a hurricane as it took a course, where sea surface temperatures were running 82° to 87°F. At the same time a strong upper level trough reached southward from the Great Lakes region. This set up accelerating south southwestward steering currents for the hurricane from North Carolina northward.

Bob reached hurricane strength at 1800 UTC on the 17th, some 205 nautical miles east of Daytona Beach, Florida. The storm intensified from 45 knots to 100 knots in 36 hours. Fortunately for North Carolina, Bob curved eastward just enough to limit destructive conditions to the Outer Banks. The National Weather Service in Buxton (interior of Hatteras Island) recorded a peak wind of 64 knots. Fifteen miles to the southeast, Diamond Shoals tower had a maximum wind of 85 knots. (2 minute average) at 0300 UTC on the 19th. The eye passed 40 miles east of Buxton and the minimum pressure at Diamond Shoals was 962.1 millibars. Six years earlier Hurricane Gloria's eye passed over Buxton with a minimum pressure of 947.5 millibars. In Gloria, Diamond Shoals winds peaked at 104 knots. While passing Hatteras, Bob was a bit weaker and more compact hurricane than Gloria.



Hurricane Bob gradually accelerated north northeastward to 30 to 35 knots after passing Hatteras. The track was nearly ideal for maintaining the eye over the warmest possible ocean until New England landfall. From Virginia to New York City, Bob produced heavy rain, rough surf, and only brief gale force winds. The eastern tip of Long Island and Block Island, Rhode Island, however, were blasted by full hurricane conditions near noon. By 1630 UTC Block Island had 91-knot gusts followed by anemometer failure and a brief lull from the west edge of the eye. Pressure increased slightly from a 950-millibar minimum off Maryland to a 960-millibar reading south of Rhode Island. As the eye moved over Newport, the Navy ship ***USS Valdez***, anchored in Narragansett Bay, reported a pressure of 964.0 millibars at 1815 UTC on the 19th.

During the next 8 hours Hurricane Bob raced north northeastward along the east coast of New England. In preparation for the hurricane, both Providence, Rhode Island, and New Bedford, Massachusetts closed their hurricane dikes. This prevented severe tidal surges in both protected cities. Exposed southern beaches from Narragansett Bay to Chatham had peak southeast winds arrive slightly after a neap high tide (below normal) started to back out. The normal tidal range is 3 to 4 feet, but in many locations 20-to 30-knot winds increased to hurri-

Vince DeWitt

Otis Air Force Base on Cape Cod lost one of its two water towers (above). Photograph courtesy of the Cape Cod Times. Power was knocked out to an estimated 2.1 million homes and businesses, primarily on the Outer Banks of North Carolina, Long Island and New England. With adjustments for inflation, Bob will rank about 13th or 14th on the list of costliest U.S. hurricanes.

cane force in an hour as core conditions arrived. Storm surges ran 6 to 10 feet above normal, possibly higher in Buzzards Bay. One storm tide value of 10 feet was measured by the Army Corps of Engineers just southwest of Pocasset on the east shore of Buzzards Bay. Hundreds of pleasure craft washed ashore and thousands of trees fell. Some boaters remained on their craft through the hurricane to prevent beaching. One of my meteorology students on summer vacation in Hyannis, Massachusetts, monitored the depth recorder after firmly anchoring his family's motor sailer. The sounding, increased from 5 feet under the keel to 13 feet in one hour, providing solid proof of an 8-foot surge. North of Chatham, offshore winds arrived at a time that limited destruction on the evening high tide.

The small intense hurricane circulation was clearly shown on a barograph at North Truro on the northeast tip of Cape Cod. The pressure fell 0.81 inches (about 27 millibars) from noon to just after 4 p.m (LDT). During late afternoon, the eye passed between Boston and Scituate, exposing the area from Wellfleet to Provincetown to full dangerous semicircle effects. Exposed spots sustained 55-to 65-knot winds up to 4 hours. Peak measured gusts were 80 to 90 knots, but isolated gusts in excess of 100 knots were estimated on the tops of bluffs facing to the southwest. A Truro resident reported that large trees ripped vertically into the sky. This observation suggests a possible tornado in an outer spiral band. Minimum pressures were 979 millibars in Truro and 970 millibars at the Cape Cod canal. A 5-to 10-millibar lower reading accompanied the eye center.

As Bob moved over the cooler waters of Massachusetts Bay, the maximum sustained surface winds continued to decrease. NOAA Buoys 44013 and 44007,

Selected NDBC Observations, August 1991

Platform/ Location	Minimum Sea-level pressure		Maximum windspeed (Knots)		
	Pressure (mb)	Date/time (UTC)	average*	Peak gust	Date/time (UTC)
Cape Lookout C-MAN CLKN7 / 34.6°N 76.5°W	998.3	19/0000	31	40	18/2200
Diamond Shoals C-MAN DSLN7 / 35.2°N 75.3°W	962.1	19/0200	85	97	19/0300
Chesapeake Light C-MAN CHELV2 / 36.9°N 75.7°W	998.2	19/0700	47	52	19/0500
Delaware Bay Buoy 44009 / 38.4°N 74.7°W	994.8	19/1000	43	54	19/1000
Five Fathom Buoy 44012 / 38.8°N 74.6°W	994.9	19/1100	46	57	19/1100
Long Island Buoy 44025 / 40.3°N 73.2°W	987.3	19/1500	44	62	19/1600
Ambrose Light C-MAN ALSN6 / 40.5°N 73.8°W	997.5	19/1500	44	48	19/1500
Nantucket Buoy 44008 / 40.5°N 69.4°W	1000.6	19/1700	47	58	19/1900
Buzzards Bay C-MAN BUZM3 / 41.4°N 71.0°W	970.8	19/1800	67	77	19/1700
Boston Buoy 44013 / 42.4°N 70.8°W	973.4	19/2000	45	59	19/1900
Gulf of Maine Buoy 44005 / 42.7°N 68.6°W	992.6	19/2300	44	55	19/1900
Isle of Shoals C-MAN IOSN3 / 43.0°N 70.6°W	975.3	19/2100	47	52	19/2100
Portland Buoy 44007 / 43.5°N 70.1°W	979.9	19/2300	41	53	19/2100
Matinicus Rock C-MAN MISM1 / 43.8°N 68.9°W	983.3	20/0100	56	64	20/0100
Mt Desert Rock C-MAN MDRM1 / 44.0°N 68.1°W	990.6	20/0200	52	61	20/0200

*NOAA buoys report an 8-minute average wind and C-MAN stations report a 2-minute average wind.

along with Mantinicus Rock and Mt. Desert Rock C-Man stations all reported sustained winds below hurricane force, justifying the downgrading of Bob to a tropical storm before making final landfall near Rockland, Maine. Excessive rains flooded Portland, Maine with 7.6 inches in 24 hours establishing an August rainfall record. Boston and Providence both set minimum monthly pressure records. After moving into New Brunswick, Canada, Bob abated to storm force early on the 20th.

In its wake Hurricane Bob left a serious economic disaster. Tourist business in late August suffered severe disruptions near Cape Cod, where some locations lacked electricity for 9 days. Seasonal revenues were off 10-20% from 1990, another poor tourist season.

Six confirmed tornadoes were reported in association with Bob, five in North Carolina and one in New York, on Long Island. Thirteen additional unconfirmed tornadoes were reported, including nine in wooded areas on Hatteras Island, two in Rhode Island and two in Massachusetts.

Rapidly moving strong hurricanes are no strangers to the Northwest Atlantic. Between 1938 and 1960 eight significant storms struck some portion of the Northeast U.S., but from 1961 until Bob, only two other hurricanes crossed New England. Belle caused hurricane force gusts in Connecticut during August 1976. Large Hurricane Gloria weakened considerably before crossing Long Island on September 27, 1985. Its late season arrival near low tide limited damage.

Many locations from Maine to Texas have gone some 25 years or more since their last major hurricane. The combination of recurring hurricane cycles and greenhouse effect warming promises a return to frequent dangerous hurricane seasons in future years. Hurricane Bob provided the East Coast with a costly reminder. The combined efforts of tropical marine meteorologists, local authorities, and individual interests reduce destruction only when everyone acts in a timely manner.

U.S. Navy Rescue

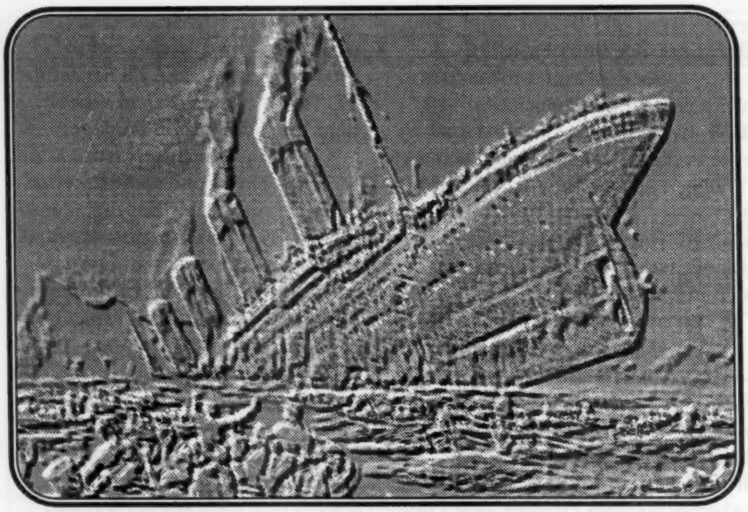
Three pleasure boaters survived 12 days at sea in a life raft after their yacht sank in Hurricane Bob.

The castaways, including a pregnant woman, ate fish they caught and seaweed during the ordeal. Bound for Newport, Rhode Island from Little River Inlet, South Carolina, the 38-foot sloop Moorings 38 sank on the 18th of August. Winds gusting to 60 knots ripped off the sailboat's mast amid waves approaching 40 feet, according to the sailors.

Survivor Edward Provost, 42, thanked U. S. Navy Petty Officer 3rd Class Steve Doerner for helping to rescue him, skipper Marc Dupaullion, 25, and Allison Wilcox, 33, about 80 miles south of Cape May, New Jersey. "This man dove into water filled with sharks to get my two crewmates out," Provost said. The three sailors had abandoned ship after hitting a waterspout. They bought along a survival kit, food and 3 gallons of water, but lost most of their provisions after the raft was repeatedly flipped by high waves. They ran out of fresh water 3 days before their rescue, forcing them to sip sea water. Provost said they saw the helicopters looking for them for 4 days before they were spotted. Doerner, 24, was part of the four-man Navy crew called in by the Coast Guard to make the rescue. He twice braved shark-filled waters to save Dupauillion and Wilcox, who were too weak to attach rescue ropes around their waists properly.

They were taken by a Navy helicopter to the aircraft carrier USS America (right) where all three were treated for exposure and dehydration.

U.S. Navy



Its been 80 years since that fateful night of April 15, 1912

A Titanic Memorial

Michael J. Mooney

For hundreds of dazed survivors in the boats, the view was incredible. Unreal. What had been the world's largest and loveliest liner on her maiden voyage just a couple of moments before, was now a stark, vertical pillar of death, silhouetted darkly against the brilliant stars and poised for her final plunge to the icy depths of the North Atlantic.

When the waters closed over ***R.M.S. Titanic*** that grim April night 80 years ago, the seed of a lasting tradition had been sown.

The very next day, through ironic coincidence, previously scheduled cornerstone ceremonies for the new Seamen's Church Institute were carried through at 25 South Street in lower Manhattan.

A short time later, it was decided to make an addition to the new building as a fitting memorial to the Titanic's 1,517 lost souls. The Seamen's Benefit Society and the American Scenic and Historical Preservation Society launched a joint subscription campaign for the erection of a memorial lighthouse and time ball device atop the very roof of the 12-story Institute building. It would overlook New York Harbor where the Titanic would have arrived at the end of her unfinished passage.

On April 15, 1913, exactly one year later, this seed flowered as the Titanic Memorial Lighthouse, whose steady green light was to shine for more than 50 years as a reminder and homecoming beacon for untold thousands of seamen under all flags.

The new Titanic Tower stood wreathed in driving mists on the rooftop that gray, rain-swept afternoon as the Right Reverend David Greer, Episcopal Bishop of New York and President of the Institute, addressed the hundreds present:

"The service that brings us together today is of great significance. We commemorate the exhibition of some of the finest and noblest elements of human nature. But this memorial service is something more than that.

"It is meant to perpetuate not only the human values on that occasion lost, but the human values of that occasion found which were then revealed."

The Titanic Memorial Lighthouse was thus dedicated:

"... in memory of the engineers who sent their stokers up on deck while they went to certain death; of the heroic band of musicians who played even while the water crept up to their instruments; of the postal clerks who bravely put duty ahead of safety; for the Marconi operators; of the officers and crew who stayed by their ship. It will be given in memory of those in the steerage who perished without ever realizing their hopes in the new land, the America of endless possibilities. It will be given in memory of all the heroic deeds by first and second-class passengers. In short, it will be a monument to every person without regard to rank, race, creed, or color, whose life went down when the giant vessel slipped beneath the waves."

The weathered green copper tower weighed nine tons and stood 216 feet above mean high water at the southwest corner of the SCI building. The beacon itself consisted of three Cooper Hewitt mercury lamps, rated at 2500 cp each. Though the light was more symbolic than navigational, it could be seen 6 miles down The Narrows at the very entrance to New York

Michael J. Mooney is a science writer and a regular contributor to the Mariners Weather Log and many other publications.

Harbor. Under optimum conditions it could be spotted up to 10 miles at sea. In fact, during its years of operation it was one of only two official Coast Guard lights on Manhattan Island, the other being the Jeffrey's Hook Light beneath the George Washington Bridge, better known as the "The Little Red Lighthouse."

The Seamen's Church Institute chose green for the beacon's color since red could not be distinguished from white or yellow beyond a certain distance. Also, it was a distinctive departure from traditional lighted navigational beacons.

Meanwhile, the famous time ball device was installed atop the light and went into service for the first time on November 1, 1913.

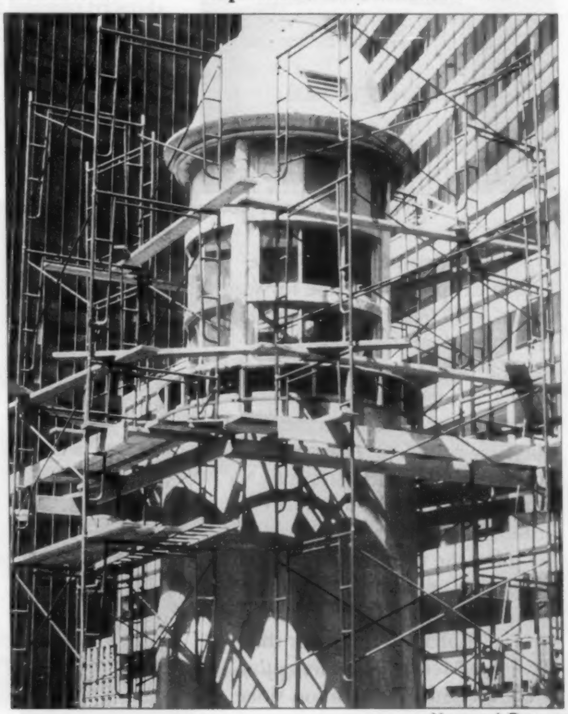
The time ball concept was essentially a pre-radio aid for synchronizing ship chronometers when in port between voyages and the SCI instrument was typical of the genre. It consisted of a hollow, bronze-framed, 200-pound ball 4 feet across the covered with black painted canvas for maximum visibility at a distance. The ball was mounted astride a hollow central rod rising 16 feet above the top of the light. Inside the rod were cables for hoisting the time ball to the top of the rod. There an electric magnet was switched on and held the ball in position. At one minute to 12 noon, a series of electric time signals or clicks came through telegraph lines connecting the time ball with the Naval Observatory in Washington, DC. After 28 clicks there was a one-second pause followed by 20 additional clicks and a 10-second pause while a switch connecting clicker to magnet was thrown.

At exactly 12 noon EST (1 p.m. EDT) the final click cut the magnet's current and released the ball on its brief plummet down the shaft. Arresting gear cushioned the ball's impact into a specially designed receiving cup. In 1913 the annual cost for this electrical timing service was a mere $72.

The time ball operated regularly every day except on weekends and holidays. Hundreds, even thousands of onlookers, residents, and visitors alike around lower Manhattan, Brooklyn Heights, and adjacent harbor waters awaited the event each day. Remember, these were pre-quartz watch days when timepieces had to be checked and reset daily. On rare occasions when mechanical malfunction, maintenance, or winter icing temporarily idled the time ball, scores of irate calls poured into the Institute, demanding to know what had happened to their faithful time check.

For many years the Titanic Light's time ball was the only surviving active instrument of its kind in the United States–perhaps even the world!

The Titanic (above) was provided by Frank Braynard. The Titanic Memorial Lighthouse pedestal is seen (right) under construction at a special park at the entrance to the South Street Seaport Museum. On the following page is the finished memorial with time ball attached and a picture of the plaque, which is attached to the little lighthouse.



Norman J. Brouwer

Standing adjacent to the Titanic Tower was a 70-foot mast complete with yard and halyards. In addition to the customary signal flags and bunting, one halyard was reserved for the International Code flag of "Z-B-H" that spelled out:

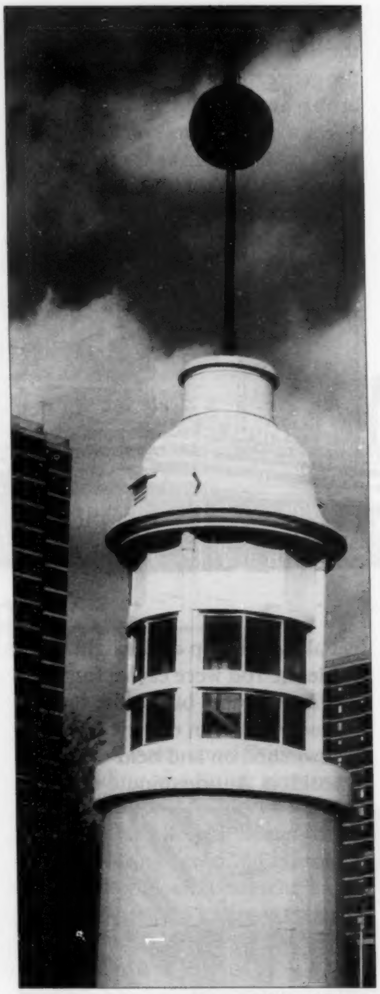
"W-E-L-C-O-M-E"

to seamen of all flags and nationalities. When maritime weather conditions threatened local small craft, appropriate storm warning flags were hoisted.

Over the years the Titanic Light's steady green light gleamed nightly as a welcoming beacon to all who knew it. During World War II, however, the light was extinguished *for the duration* as were most other beacons around the world. On the other hand, the time ball continued its daily plunge at the stroke of noon.

Every year on April 15, memorial services were held at the Institute to commemorate the Titanic disaster. In 1965, though, a change in the annual observance was foreseen when the old SCI building was put up for sale. A need for larger, modern quarters dictated this decision and soon construction of a more modern facility was underway. In the fall of 1967, the celebrated time ball quietly ceased operations as SCI's Deputy Director, Dr. Roscoe T. Faust, explained: "It needed to be repaired and we decided it wasn't worth it so soon before we moved." Public reaction was surprisingly minimal, since most people knew the building was soon coming down. The famous Titanic lighthouse and its time ball had served New York City well for 55 years.

The following April the Institute did move to its new home and demolition of the old building commenced. On July 24, 1968, the Titanic Memorial Lighthouse and Time Ball were lowered intact to street level by the Kaiser-Nelson Steel and Salvage Company and presented, gratis, to the South Street Seaport Museum several blocks up the East River. There it lay for 7 years on the Museum's Pier 16 while funds were being raised to construct a suitable setting and new home for the venerable memorial.



Michael J. Mooney

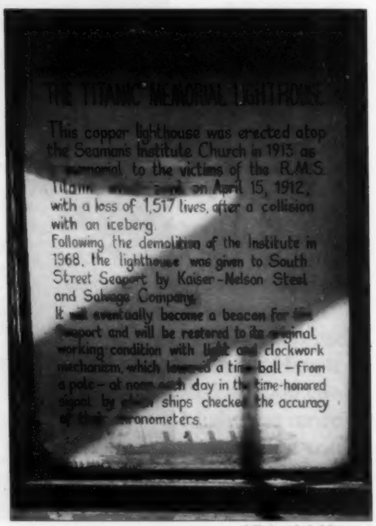
In September 1975 the Exxon Corporation came forward with a $200,000 challenge grant to erect the Memorial on its own brick and masonry pedestal as the central jewel in a specially constructed park at the entrance to the museum complex. It was part of South Street's contribution to NY City's gala 1976 bicentennial celebration, an extravaganza that included the memorable Operation Sail and International Naval Review.

Matching funds for the showcase Memorial came, aptly, from the Astor Foundation since Colonel John Jacob Astor was one of those lost on the Titanic decades before.

Today the original lighthouse and time ball adorn Titanic Memorial Park and welcome all to South Street Seaport's many nautical delights. A memorial bronze plaque, affixed to the masonry pedestal at the South Street Seaport Museum, commemorates the Titanic disaster and briefly describes the light and time ball's varicolored history (below).

The Museum has announced that the light and time ball will be reactivated-again, when necessary funds are raised. Then lower Manhattan will, once more, have one of its most cherished maritime icons on an active schedule.

There is no new time ball nor lighthouse atop the new Seamen's Church Institute building at 241 Water Street. Rather, the entire fifth and sixth floors are built of white enameled steel in a design reminiscent of the upper decks of ships to remind mariners and landsmen alike that the Institute is still berthed at Manhattan isle, serving the needs of seamen of all nations as it has for more than 150 years.



Michael J. Mooney

ICE PATROL

— A Titanic Legacy

Commander J. J. MURRAY

Within 2 years of that fatal April night 80 years ago, the International Ice Patrol IIP) began operation. The U.S. Coast Guard has conducted the service ever since 1914, with the exception of six war years.

IIP's mission is to warn mariners, in particular trans-Atlantic shipping, of the danger posed by icebergs in the vicinity of the Grand Banks off Newfoundland, Canada. The existence of IIP is directly linked to the sinking of the ***RMS Titanic*** on April 15, 1912 after colliding with an iceberg south of the Grand Banks. This legendary maritime tragedy precipitated an international convention (the Safety of Life at Sea (SOLAS) Convention of 1913) which, among several safety initiatives, called for the establishment of an ice patrol in the North Atlantic Ocean to preclude the recurrence of a similar tragedy. Since 1914 the Coast Guard has been entrusted with conducting the ice patrol, and each passing season poses the question of what to expect for the following year.

So what will the 1992 iceberg season bring? That's the question on the minds of the staff of the U. S. Coast Guard's International Ice Patrol (IIP) and the network of organizations which support IIP operations. After two consecutive unusually severe seasons, the prospects for the 1992 season are indeed intriguing.

Iceberg Season

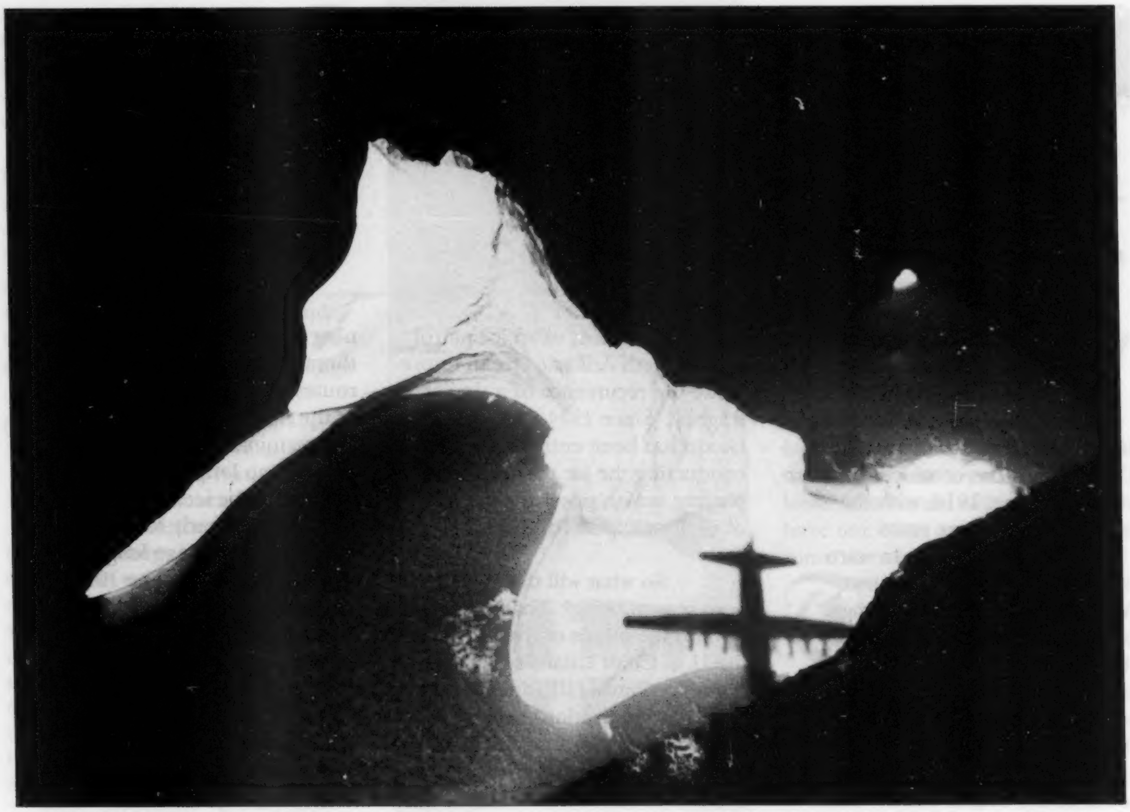
IIP operations are seasonal, beginning when icebergs start to pose a threat to the great circle shipping routes between Europe and ports of the northeast U. S. and Canada, and terminating when the iceberg threat is no longer significant. Generally, the iceberg season extends from early March to mid July, with an average length (since 1946) of 130 days. The 1990 season was longer than normal extending for 160 days (March 9–August 15), but it did not approach the 183 day-long 1991 season (23 February–August 24), the fourth longest season on record (189 days in 1972 and 1973 being the longest).

Report Needs

To warn mariners of the extent of the threat posed by icebergs IIP

Commander J.J. Murray is the Commander of the International Ice Parol, which is located in Groton, Connecticut.

These icebergs were sighted off the coast of Greenland, after calving from that continent's glaciers. Since their origin is land-based, they are known as dry-dock icebergs.



Russ Kinne Ltd.

must closely monitor their distribution in the northwest Atlantic, using information from a variety of sources. Reports from shipping and from IIP's aerial reconnaissance flights are the most important. These two sources combined contributed more than 86 percent of the sighting reports received by IIP in 1991.

Sources of Sightings

Source	%of total
Commercial Ship	51.2
Coast Guard (IIP)	34.4
Other Air Recon	9.0
Canadian AES	4.4
DOD Sources	0.8
Lighthouse/Shore	0.2

Recon

Aerial reconnaissance conducted by ice reconnaissance detachments (ICERECDETs) provides IIP with a first-hand look at the iceberg conditions. They employ Coast Guard long range (HC-130) and medium range (HU-25) aircraft equipped with all weather, side looking airborne radar (SLAR) capable of detecting small icebergs and even growlers in low sea states. The aircraft operate from St. John's, Newfoundland on an every other week basis during the season. Reconnaissance is generally focused on the periphery of the iceberg distribution to locate or verify the key "limit setting" icebergs. However, they do not provide the majority of IIP's iceberg reports.

Ship Reports

During the 1991 season more than 51 percent of iceberg sighting reports originated from shipping. These reports are critical to IIP's success because of the vastness of the operations area (40°N to 52°N, 39°W to 57°W) and the number of icebergs which must be tracked. During an average season about 400 icebergs are transported by ocean currents into IIP's area of concern south of 48°N. Though this is only a fraction of the 10,000 to 20,000 icebergs which are calved from Greenland's glaciers annually, it is still a lot of icebergs to track. During the 1990 season, about 800 icebergs were reported or predicted to have drifted south of 48°N. The 1991 season was even more extraordinary with about 2000 ice-

ICEBERG CLASSIFICATION

DESCRIPTIVE NAME		HEIGHT (feet)	(meters)	LENGTH (feet)	(meters)
Growler	(G)	less than 17	less than 5	less than 50	less than 15
Small Berg	(S)	17-50	5-15	50-200	15-60
Medium Berg	(M)	51-150	16-45	201-400	61-122
Large Berg	(L)	151-240	46-75	401-670	123-213
Very Large Berg	(V)	greater than 240	greater than 75	greater than 670	greater than 213

SHAPE		DESCRIPTION
Non-Tabular	(N)	This category covers all icebergs that are not tabular-shaped as described below. This includes bergs that are dome-shaped, sloping, blocky, and pinnacle.
Tabular	(T)	Flat topped iceberg with length-height ratio greater than 5:1.

Left, a Coast Guard HC-130 aircraft is silhouetted against a drydock iceberg.

bergs crossing 48°N; the season's total was the second highest on record.

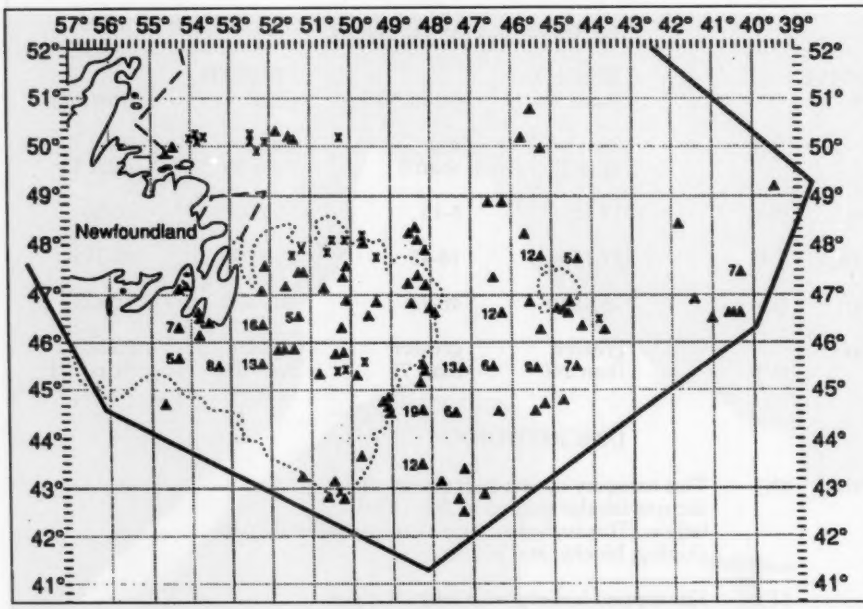
To help keep track of these large numbers of icebergs IIP gratefully receives reports from shipping operating in its area of responsibility. Ships are requested to provide the following information: ship name and call sign, position of any ice sighted (or vessel position if no ice sighted), time of sighting, sighting method (visual, radar or both), size and shape of iceberg, sea ice concentration and thickness, and sea surface temperature. These reports can be made to any Canadian Coast Guard Marine Radio Station or U. S. Coast Guard Communications Station.

Ice In/Warnings Out

All iceberg sighting reports, from whatever source, are relayed to the IIP Operations Center in Groton, Connecticut where they are compiled and entered into computer models which predict iceberg drift and deterioration. The models help watchstanders determine if reports are new sightings or resightings of previously noted icebergs. The output of these models is used to estimate the limit of all known ice. This limit is broadcast to mariners twice daily as an Ice Bulletin and once a day in radiofacsimile form. During the 1990 season anomalous oceanographic conditions resulted in several icebergs drifting south of 40°N, the southern extent of IIP's drift model. This rare occurrence required intensified reconnaissance of the area and special handling by the Operation's Center to estimate the limit of all known ice. Luckily, the 1991 season with its tremendous number of icebergs did not see the recurrence of such unusual oceanographic conditions and no icebergs were sighted south of 41°N (none were predicted to have drifted south of 40°30'N).

Ice Outlook

Will the 1992 season see a repeat of the extraordinary iceberg distributions of the 1990 season or the tremendous number of icebergs encountered during the 1991 season? The answer to this question depends primarily on the factors affecting iceberg transport (ocean currents, winds) and deterioration (sea ice extent, wave action, sea surface temperature). Inherently, these factors are very difficult if not impossible to predict. The most recent sea ice and environmental forecasts from Canada's Atmospheric Environment Service lead one to expect a more "normal" season in 1992 than the last two years. Since the establishment of the International Ice Patrol there has not been a single loss of life or instance of property damage due to collision with an iceberg outside IIP's advertised limit of all known ice (i.e. in the area noted to be free from icebergs). Whatever the 1992 season holds in store, IIP will make every effort to keep this record and its proud tradition of service to the mariner intact.



Graphic Depiction of International Ice Patrol Plot for 1200 UTC, June 30, 1991 (based on observed and forecast conditions)

N ▲ Berg

N ▲ Growler

N X Radar Target/Contact

——— Estimated limit of all known ice

- - - - Estimated limit of sea ice

·········· 200 meter bathymetric curve

N is number of designated targets in 1° rectangle

International Ice Patrol Broadcasts

BROADCAST STATION	TIME OF BROADCAST (UTC)	FREQUENCIES (KHZ)
NAVTEX BROADCAST Coast Guard Communication Station Boston/NIK	0445, 0845, 1245 1645, 2045, 0045	518
NBDP (FEC) BROADCAST Coast Guard Communication Station Boston/NIK	0030 1218	6314, 8416.5,12579 8416,5 12579 16806.5
CW BROADCASTS Coast Guard Communication Station Boston/NIK (Bcst to follow NBDP bcst)	0050 1250	5320, 8502, 12750 8502, 12750
Canadian CG Radio Station St. John's/VON	0000 1400	478
Canadian Forces METOC Centre Halifax/CFH	0015, 1101 1301, 1401 2201, 2301	122.5 Continuous (off air 1200-1600 second Thurs. each month) 4271 (2200-1000 UTC) 6496.4 Continuous 10536 Continuous 13510 (1000-2200 UTC)
Canadian Coast Guard Radio Station Halifax/VCS	1330 2200	4285, 6491.5, 8440, 12874, 16948, 22619.5 (Broadcast on frequencies as advertised by CN marker tape)

BROADCAST STATION LCMP BROADCAST	TIME OF BROADCAST (Z)	FREQUENCIES (KHZ)
Norfolk, VA NMN/NAM/NAR	0800-0900 1500-1600 1600-1700 1200-0000	8090 Continuous 12135 Continuous 16180 Continuous 20225 Continuous
Key West, FL/NAR	same times 1200-0000	5870 Continuous 26725 COntinuous
RADIOFACSIMILE BROADCASTS Time Z	Frequency kHz	
Coast Guard Communication Station Boston/NIK	1600	8502, 12750 (+/- 400Hz)
Radio Station Bracknell United Kingdom/GFE (Eastern North Atlantic Sea Ice Observations)	1413	2618.5 (1800-0600 OCT 1-MAR 31; 1900-0500 APR 1-30 SEP) 4782 Continuous 9203 Continuous 14436 Continuous 18261 (0600-1800 OCT 1-MAR 31; 0500-1900 APR 1-30 SEP)
Canadian Forces METOC Centre Halifax/CFH (Primarily sea ice in Gulf of St. Lawrence and North. Limits of icebergs sometimes given.)	0015, 1101, 1301, 1401, 2201, 2301	122.5 Continuous (Off air 1200-1600 second Thursday each month) 4271 (2200-1000 UTC) 6496.4 Continuous 10536 Continuous 13510 (1000-2200 UTC)
RADIO TELEX		
Canadian Coast Guard Marine Radio Station Halifax/VCS	0630 1630 2300	4213.5 8419.5 4213.5
SPECIAL BROADCASTS		
Canadian CG Radio Station St. John's/VON	As required when icebergs are sighted outside the limits of ice between regularly scheduled broadcasts	2598 Radiotelephone preceded by Inter-Safety Signal (SECURITE) on 2182 kHz. 478 (CW) - Preceded by International Safety Signal (TTT) on 500 kHz.
Coast Guard Communication Station Boston/NIK	As required when icebergs are sighted outside the limits of ice between regularly scheduled broadcasts. NAVTEX upon receipt or first available BCST window. NBDP (FEC) next scheduled BCST.	472 (CW) preceded by International Safety Signal (TTT) on 500 kHz.
International Ice Patrol Vessel/NIDK (when assigned)	When in the vicinity of ice in periods of darkness or fog.	2670 Preceded by International Safety Signal (SECURITE) on 2182 kHz.

The Eskimo Lights

Elinor DeWire

Elinor DeWire

The first lighthouse on North America's Pacific Coast was established in 1805 at the quaint port of Sitka, Alaska. Flanked on the east by towering, ice-capped mountains and to the west by the mercurial Gulf of Alaska, Sitka was then a Russian trading post under the shrewd management of entrepreneur and governor, Aleksandr Baranov.

The governor's home, known as Baranov's Castle, was a bold citadel facing the sea, and it served not only as a welcome landmark for vessels headed into Sitka Bay, but also as a fortress against the native Tlingits who had destroyed a previous outpost at Sitka after mistreatment by Russian traders. Atop the castle was a cupola where a light was shown. In addition, Baranov ordered a small lighthouse built on an island at the entrance to the bay.

> The Alaska that had once been dubbed "Seward's Folly" and the "Ice Box of America" beckoned with boundless opportunity.

The island light vanished sometime in the 1830s, but the beacon in the castle was still shining when the U.S. annexed the Alaska Territory in 1867. An army post was quickly set up, with an ordinance officer given responsibility for the beacon. He was paid an extra 40–cents a day to keep its seal oil lamps burning and the windows clean. The beacon was maintained for 10 years, then abandoned when the army withdrew from Sitka. From 1877 to 1902, the Alaska shores—with half again as much coastline as the continental U.S.—were dark.

Gold was the spark that finally lit the Alaskan coast. Klondike prospectors arrived by the thousands in 1897–98 via Lynn Canal and Skagway. While gold fever raged, shipping attempted to keep up with the need for transportation of people and goods. By this time, a number of buoys had been placed along the perilous Inside Passage, but fog, swift currents, and hidden rocks still exacted a heavy toll. The Alaska that had once been derisively dubbed "Seward's Folly" and the "Ice Box

National Archives

Sentinel Island Light as it existed in the Lynn Canal in 1915. It was rebuilt in 1935 and burned down in 1966.

PAC Ed Moreth, USCG

of America" beckoned with boundless opportunity. Lighthouses were needed to show the way.

In 1902, the first major Alaskan light stations were established at Southeast Five Finger Island in Frederick Sound and Sentinel Island in Lynn Canal.

Perhaps the government was slow to act because of the enormous expense and hardship of lighting the nation's largest piece of real estate.

Urgent sites for Alaskan lighthouses were isolated and treacherous–some more than 3000 miles from the Lighthouse Depot at San Francisco. Eventually, a separate district was established for Alaska, headquartered in Ketchikan and later moved to Juneau. But the early lights were built by the crews of steam-powered tenders out of Seattle–tough little vessels with dainty, floral names like ***Rose, Fern, Armeria,*** and ***Columbine***.

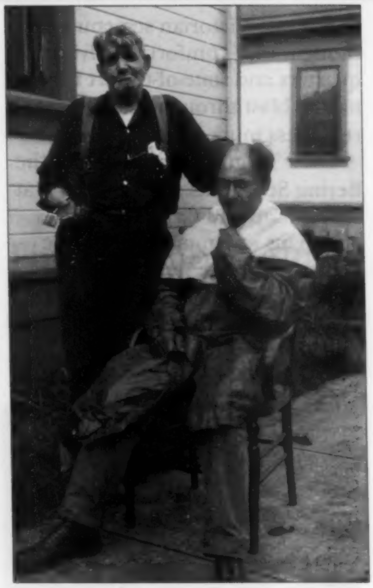
In 1902, the first major Alaskan light stations were established at Southeast Five Finger Island in Frederick Sound and Sentinel Island in Lynn Canal. Despite the wet, chilly climate, and the ever-present threat of fire in the lantern, the towers were built of wood to save money. They were handsome Victorian structures though, with comfortable living quarters and state-of-the-art fog signals to blast through Alaska's relentless murk.

To guide shipping into the Bering Sea, lights were also built at Scotch Cap and Cape Sarichef as guardians of Unimak Pass in the Aleutians. These were made *stag stations*, since they were deemed too remote for families. The men who served at them were often chosen from the stalwart native population, for it required enormous courage and fortitude to handle the deprivations of life on a barren island.

Ted Pedersen was such a man–born in 1905 on remote Samalga Island to an Alaskan fur trader and his Russian-Aleut wife. Pedersen served aboard the tender ***Cedar***, which supplied the outer Alaskan lights in the 1920s, then received an appointment to Kayak Island's Cape St. Elias Light after one of its keepers went mad.

Pedersen disliked duty on

Five Finger Lighthouse (above) was one of the first major light stations established in Alaska. The Five Fingers are a group of islets about 6 miles north northwest of Cape Fanshaw, which is on the east side of the junction of Stephens Passage and Frederick Sound. Ted Pedersen (right) was the assistant keeper and keeper of Cape Sarichef Light Station (1929–1935). He is displaying brown bear hides, from bears he shot on station.



Kayak Island, calling it "the worst in Alaska." Storms were terrifying and living conditions so dangerous the service tender came just once a year. Often, supplies ran low and meals were lean.

"If we saw seagulls flying around eating something–halibut or rock cod washed up–we'd go down and look, and maybe we'd take it away from the gulls," Pedersen recalls.

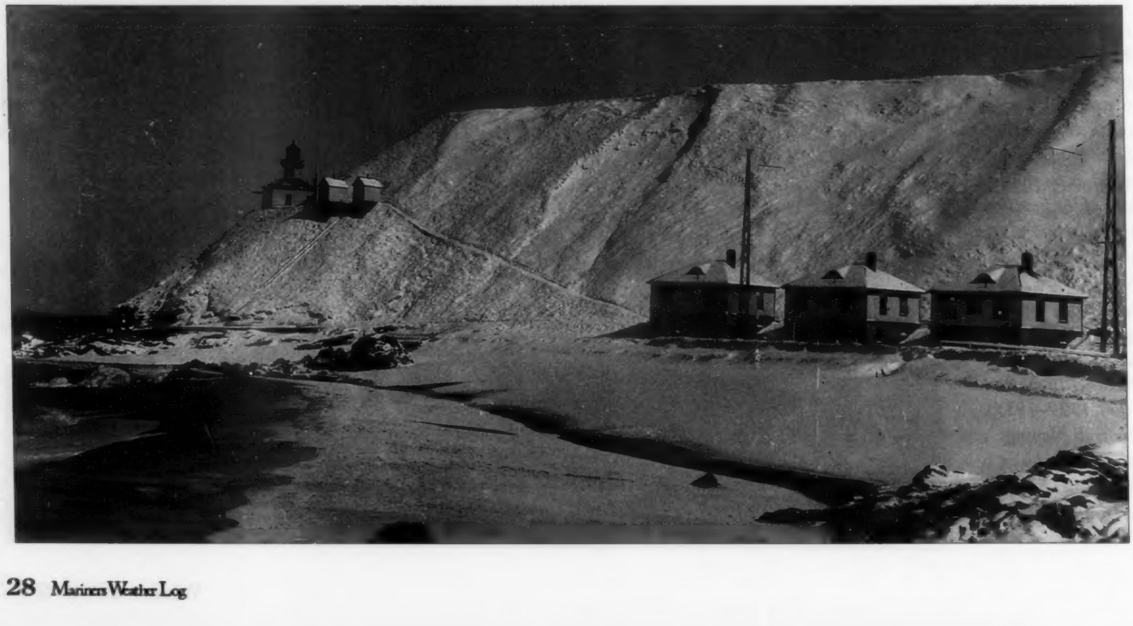
Within a year, another position opened at isolated Cape Sarichef Light. One of the assistant keepers had suffered a breakdown after 2 years at the lonely station. Pedersen replaced him and, having spent part of his childhood in the Aleutians, found life at Cape Sarichef more to his liking. He hunted, explored the island, and read hundreds of books. A magazine article described him as "The Lighthouse Keeper at the End of the World" and noted that he wore a reindeer parka with as much finesse as a three-piece suit.

At times, even the greatest fortitude, outdoor skill and common sense weren't enough on the rugged Alaskan landscape.

Cooking was one of Pedersen's favorite pursuits, and he was known for his mulligan stew made with fresh caribou meat. In deep winter, when the station was shut down for three months, Pedersen sometimes made hikes around Unimak Island. One of these was a 263-mile trek to see a schoolteacher. Pedersen was 29 at the time, and women were a rare sight on Unimak Island.

Other less hardy keepers did not adapt as well as Pedersen. In 1918, one of the Cape Sarichef crew became ill, and a tender was summoned to take him to a hospital. When the tender arrived, the water was too rough to dock, so a launch was sent to the lighthouse. It didn't make it; waves swamped the boat and all of its occupants drowned. While the tender waited at anchor for calmer seas, the keeper died. He was buried behind the station on "Graveyard Hill."

A bureau bulletin mailed to lighthouse keepers nationwide in February 1921 carried a firm warning about the dangers of the Alaskan wilderness. The notice was occasioned by the loss of two men near Mary Island Lighthouse. Keeper Herbert Scott and two friends from nearby Ketchikan had gone to the aid of a stricken boat.



As they returned to the lighthouse, they lost the trail in fresh snow and wandered off into the dense woods. Two of the men, including Scott, froze to death. The Bureau of Lighthouses called it "a needless accident."

Most of the old wooden lighthouses in Alaska were replaced with more durable concrete structures by the time the Coast Guard took over navigational aids in 1939.

At times, even the greatest fortitude, outdoor skill and common sense weren't enough on the rugged Alaskan landscape. Five keepers lost their lives at Scotch Cap Light in 1946 after a seismic disturbance in the Aleutian Trench spawned a monster tsunami that destroyed the station. The lighthouse actually slid into the sea.

During Prohibition, the keepers at Guard Island Lighthouse discovered a boat adrift and rowed out to investigate. They found the mangled bodies of two men stuffed inside a locker in the boat cabin. The shocking crime was blamed on bootleggers. Guard Island's lightkeepers began carrying guns at all times. This station was one of only three in Alaska where families were allowed, and the men were concerned for the safety of their wives and children.

Most of the old wooden lighthouses in Alaska were replaced with more durable concrete structures by the time the Coast Guard took over navigational aids in 1939. Because of the emotional and physical hardships of keeping Alaska's outer lights, some new rules were instituted. Keepers were required to serve only a year at remote stations and were visited by tenders more often. In addition, plans were made to automate these lonely outposts as soon as possible.

By the close of the 1960s most of the Eskimo lights were self-sufficient and their keepers transferred back to civilization. The Northern Lights began dance to a new song–the hum and click of automatic machinery. No one remained to hear the Taku winds whispering through cracks in the walls or feel the shudder of the sea throwing itself against the shore. Bears no longer had garbage cans to raid; the caribou didn't risk becoming steaks in a lighthouse freezer.

A cute family of martens has taken up residence at Cape St. Elias Light, and the Coast Guard's periodic maintenance team sometimes leaves food for them. Seals and seabirds have made themselves at home around Eldred Rock, Cape Hinchinbrook, Cape Spenser, and other sentinels of the far north, but they shun human contact, preferring to watch from a distance when tender crews arrive to check the lights.

Such changes seem to suggest sequestered spots like these are better suited to beasts than men.

Ed Moore, keeper of the Light Station at Cape Sarichef, gives assistant keeper Ted Pedersen a haircut after Ted returns from a year's leave with pay, in 1930. Each keeper was given one full year off in each 4 years of service, in areas where access to the stations was difficult. The Cape Sarichef Light Station picture (left) is circa 1929. The light is 170 feet above the water. Both photos are courtesy of Ted Pedersen. In addition to the rigor of wind and weather, many of these lighthouses are susceptible to tsunamis–giant waves triggered by earthquakes or seaquakes. Cape St. Elias Lighthouse (right), some 85 feet above the water was nailed by a wave from the 1964 Alaskan Earthquake. The wave swept Cape St. Elias Lighthouse and killed Coast Guardsman Reed and his two companions, dogs Wolf and Midnight.

U.S. Coast Guard

How can satellite photographs show anything about sea surface temperature?

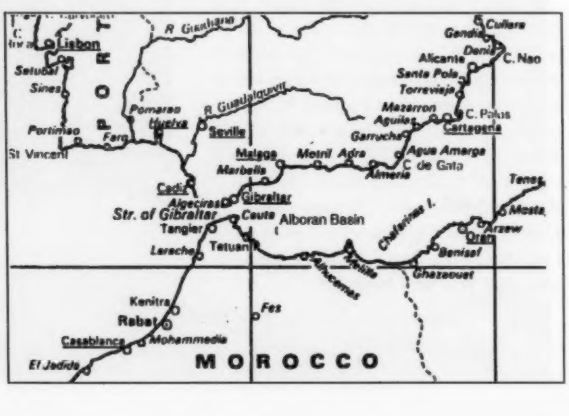
G.A. Monk
Meteorological Magazine

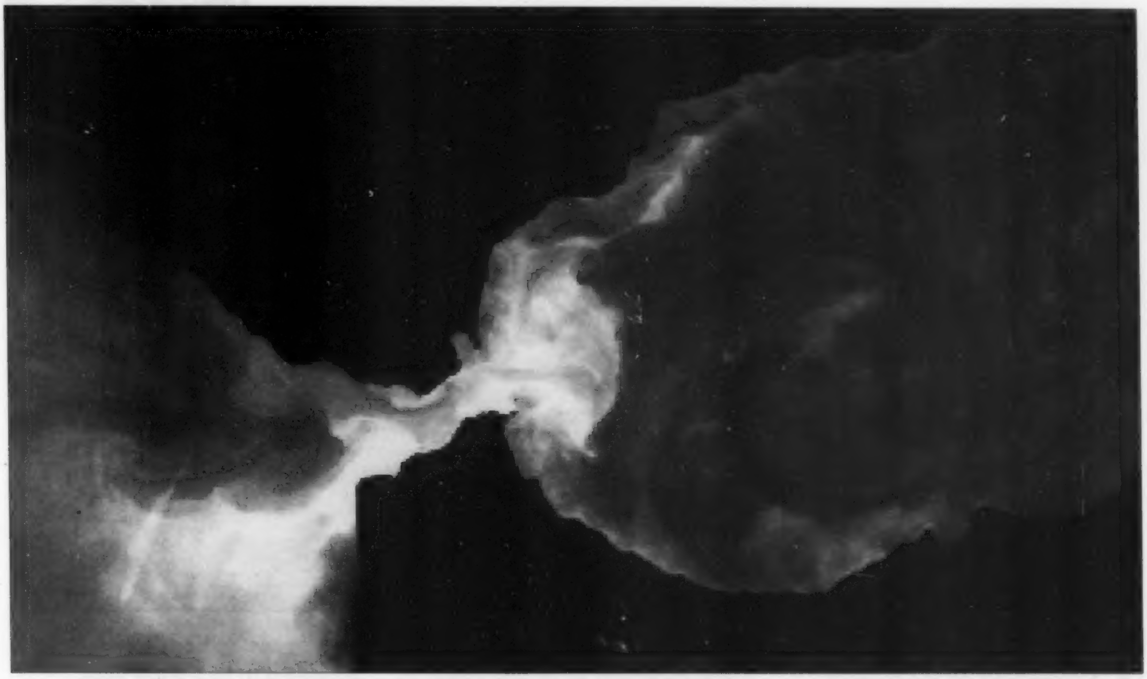
An excellent example of just how effective satellite photographs can be in determining sea surface temperature patterns appeared in the British publication, Meteorological Magazine of November 1991 (volume 120, number 1432). The photographs were kindly provided by the University of Dundee. Permission to use this column was granted by the Controller of HMSO. ***–editor***

The NOAA-10 infra-red image (top, page 31) illustrates the pattern of sea surface temperature near the Strait of Gibraltar and the Alboran Basin. The image has been enhanced so that the whole gray-scale range (from black to white) occurs within a few degrees Celsius (approximately 17 to 22°C)–corresponding to the range of sea surface temperatures. The visible image taken at the same time (page 31, bottom) indicates that only a few patches of cloud are present over the sea, and hence confirms that almost all the structure seen over the sea in the infra-red image is due to variation in the sea temperature.

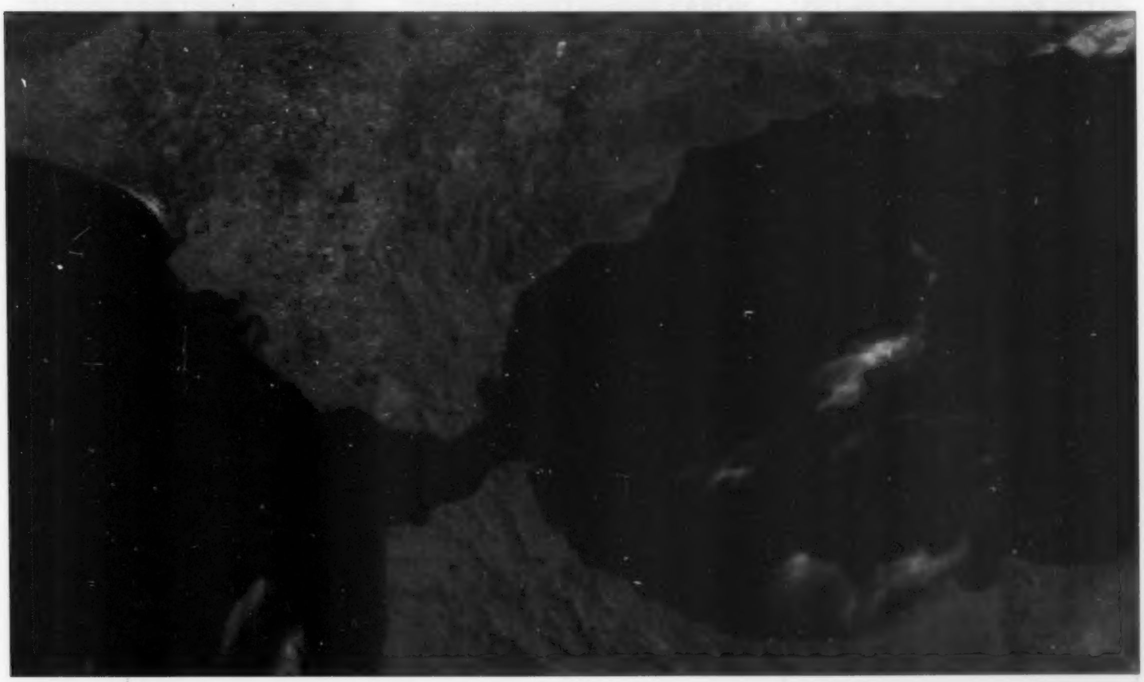
The main feature is the region of cold water close to the Strait of Gibraltar. Daily inspection of infra-red images suggest it to be commonly observed, particularly during the summer months, although there are often significant day-to-day differences in its pattern. In the Alboran Basin, large anticyclonic gyres are normally present which sometimes draw in cold water from the Strait of Gibraltar.

The cold sea can have significant effects on the weather. For example, at Gibraltar, the highest incidence of sea fog occurs in August. A change of wind direction to an easterly bringing moisture-laden air from the Alboran Basin frequently results in either fog or very low cloud, whereas onshore winds at observing stations in the Alboran Basin, away from the region of cold water do not lead to these conditions.





The NOAA-10 infra-red image for 0805 UTC on the 27th of June is shown above. In this enhanced version the land mass shows up as mostly black. Below is the visible satellite image, taken at the same time. Photographs are courtesy of the University of Dundee, Scotland.



NOAA Gets Closer Look at the Civil War

Jerry Slaff

Somewhere off the coast of Cherbourg, on the French side of the English Channel, the USS ***Kearsage*** battled the CSS ***Alabama***, the most feared Confederate cruiser of the Civil War. It was June 19, 1864, and for 2 years the ***Alabama*** had been wreaking havoc on Union commerce all over the world.

"...Whenever a Union vessel spotted a sail, even if they knew the ***Alabama*** was on the other side of the world, they'd run. The ***Alabama*** was spotted in more places than Elvis."

"The ***Alabama*** would travel the world over looking for union merchant ships, and easily overpower them" says Ervan Garrison, a marine archaeologist with NOAA's National Ocean Service. "The crew was heavily armed, much more than the merchant marine ships. If they were feeling particularly ornery, they'd burn the captured ship. Whenever a Union vessel spotted a sail, even if they knew the ***Alabama*** was on the other side of the world, they'd run. The ***Alabama*** was spotted in more places than Elvis."

Vexed, the Union sent the ***Kearsage*** after the ***Alabama***.

Today the ***Alabama*** is still at the bottom of the English Channel. Strong tides and a 180-foot depth have kept many divers from the wreckage.

Confident from 2 years of sailing the world with impunity, the ***Alabama*** was ready for what promised to be a good fight. Englishmen and Frenchmen lined up on either side of the Channel to watch. Smaller boats lined the shores.

The Kearsage got in the first rounds. The ***Alabama*** retaliated, but took a fatal hit and began to sink. A British sloop picked up the crew, thwarting hopes of the commander of the ***Kearsage*** of capturing them. In Confederate-supporting England, the mostly British crew of the ***Alabama*** received a hero's welcome. But the threat of the ***Alabama*** to the American merchant fleet was over.

Today the ***Alabama*** is still at the bottom of the English Channel. Strong tides and a 180-foot depth have kept many divers from the wreckage. Now the French government is proposing an extensive study of the shipwreck. Garrison is part of a team of experts brought in by French and american officials to advise on the opera-

Jerry Slaff is the Publications Officer for the National Oceanic and Atmospheric Administration, and, hopefully, we will see more of his writing in the Log in the future.

tion.

Most of the ***Alabama,*** which was powered both by sails and a steam engine, is still in good shape, except for part of its side and the upper deck, its bow and masts. "From a video the French shot in 1989, you can see that the rudder's still there, and so are the machinery and the guns," said Garrison.

"I want to reconstruct a Confederate raider," said Garrison, "and find out what the crew had with them. What did they eat and drink, and how did they cook?"

The ship's bell had disappeared, however. It was found in a pub in one of the British-owned Channel Islands, where it was used to sound the last call each evening. The bell was sold to someone in the United States. The U.S. government sued for ownership, claiming the bell was government property. "That is ironic," Garrison said, "because it was from a confederate ship." The government won the case and the bell now is slated to go to the Naval Academy at Annapolis.

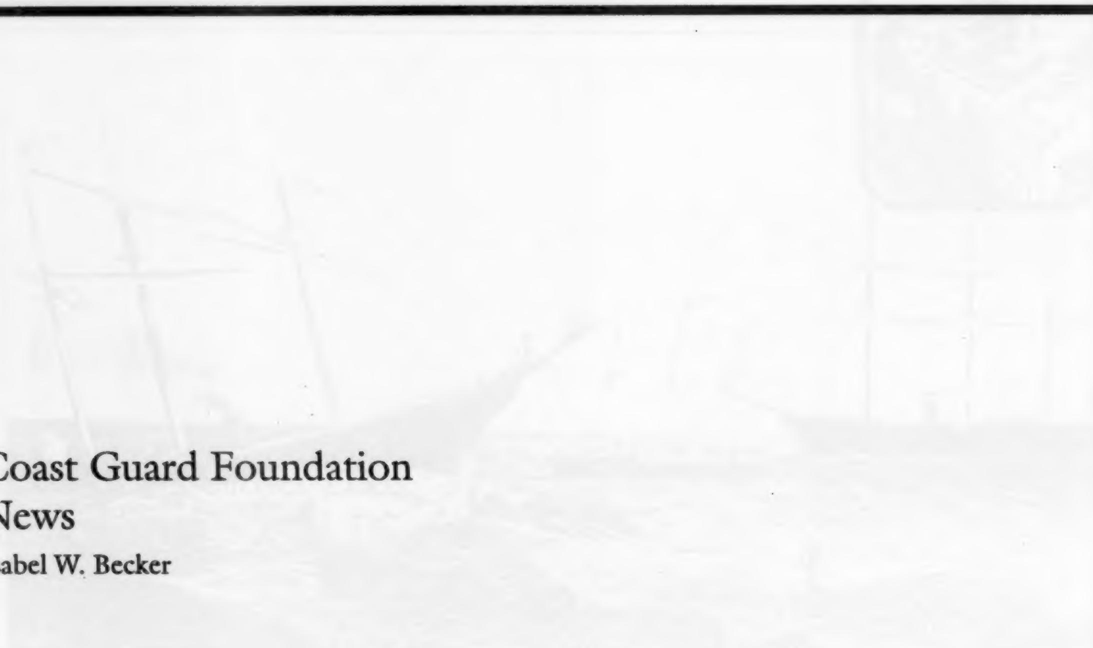
Garrison is interested in the "nuts and bolts"—the small artifacts that still remain on the vessel. "History focuses on the overall," he said, "but archaeology often focuses on smaller aspects. For instance, the ***Alabama*** was 2 years old when it fought the Kearsage. Would a showdown 2 years sooner, when it was new, have had a different outcome? A large shell was found in the ***Kearsage***, but the fuse was so worn it didn't explode. Why didn't it, and what if it had?

"I want to reconstruct a Confederate raider," said Garrison, "and find out what the crew had with them. What did they eat and drink, and how did they cook?"

With NOAA since January 1990, and formerly on the faculty at Texas A&M University, Garrison inherited the archeological aspects of the ***USS Monitor*** sanctuary, which is administered by NOAA. The Union warship and the ***Alabama***, though contemporaries, are very different.

"The ***Alabama*** was the equal of the ***Monitor***, but the ***Monitor***, the icon of the Union naval forces in the Civil War, was really the first modern warship. It was ugly but effective," Garrison said. "The ***Alabama*** fits the image of a true 19th century warship...and it went down with guns blazing."

The Navy Museum, at the Washington Navy Yard, Washington DC, is featuring relics from the ***Alabama*** *in an exhibit entitled* Lost and Found, *through June 31, 1992. The artifacts recovered, by the French Navy, from the debris field surrounding the wreck, have been generously given to the U.S. Captain Max Guerout of the French Navy and his divers, took care not to disturb the intact core of the vessel as seen on video in the exhibit.*



Coast Guard Foundation News

Isabel W. Becker

The Coast Guard Foundation, a public, non-profit organization, began in 1969 with a commitment to enhance the lives of Coast Guard men and women. It does this by raising funds for programs and projects at the Coast Guard Academy and at Coast Guard stations throughout the world. Monies raised benefit those projects that cannot be supported by the government because of budget or charter restrictions. It works with the Commandant and the Academy Superintendent to develop projects where need is demonstrated.

Six Coast Guardsmen Honored for Outstanding Service

The storm that swept up the East Coast on Halloween eve didn't dampen the spirits of those heading to Manhattan for the Coast Guard Foundation's 1991 Salute to the Coast Guard Awards Dinner. Over 700 special friends of the Foundation attended this event.

Even to the most jaded New Yorkers, the Foundation Salute is not just another night out. It is an exciting evening where the Coast Guard is duly recognized for the vital tasks they perform every day in service to our nation. In many cases these heroic actions involve weather-related problems.

In one of those weather-related activities, Atlantic Area Commander Vice Admiral Paul Welling was greeted by cheers as he announced to the packed ballroom the successful search and rescue of a National Guard helicopter crew downed in the Halloween Storm the day before.

The twelfth annual salute paid tribute to six outstanding men and women, who were selected this year to receive awards for their dedication, professionalism, and bravery. The audience was treated to an exciting audio/visual presentation reenacting the events for which the six were honored.

It is rare to capture a search and rescue on camera as it takes place, but the audience got to see Lt. Laura Guth in action. The fishing vessel ***Alaskan Monarch*** was trapped in the ice-encrusted water near St. Paul, Alaska, an island in the middle of the Bering Sea. Here, 45-knot winds and 30-foot seas slammed into the crippled boat, forcing the crew of six to abandon ship. The cutter ***Storis*** was nearby but could not get close enough to the boat to help. An H3 helicopter was dispatched to the scene from Air Station Kodiak. Lt. Guth was the pilot. Flying over 6 hours in an arctic storm, Guth and her crew reached the scene just as the storm had taken a turn for the worse. As four fishermen assembled on the bow, a rescue basket was lowered. Conditions were perilous, but four flawless lifts were executed. Two men remained. As they crossed the deck to the hoisting area, a 30-foot wall of ice smashed into the vessel broadside, sweeping the two into the icy water. The basket was lowered and somehow one of the men managed to grab the basket, swinging in gale-force winds. The last man, the ship's captain, was pinned under the ice and a rescue swim-

Vice Commandant VADM Martin Daniell Jr (left) with the 1991 Coast Guard Foundation Award honorees, left to right (rear): CWO2 John Kimmel, BM3 John Huard, Mr. Donald Merwin; (front) LT Laura Guth, CAPT Thomas Green and BM3 Albert Smythe. The photograph was taken by Isabel W. Becker.

mer was sent down to pull him free. Miraculously, all six men survived, unharmed.

Petty Office Albert Smythe received honors for his heroic rescue of a woman swept overboard from a sailboat during a storm off the Santa Barbara, California coast. Smythe was the rescue swimmer from the USCGC ***Point Carrew***, which responded to the distress call. The ship searched the scene for hours. Frustrated by darkness and bad weather, it was about to return home when crewmen on board heard the woman's screams. A small inflatable boat carrying Smythe and a coxswain was launched into the rough waters. Smythe swam to the women, who had grabbed a tow line, and then acted as a shield as the two were swept by the heavy seas into the cutter's coxswain, who had been standing by in the small inflatable boat.

The Foundation paid tribute to Petty Officer John P. Huard, who rescued seven fishermen from the ill-fated vessel, ***Aristocrat***. While serving as coxswain of a 19-foot inflatable boat off the cutter ***Tamoroa***, Huard raced to the fishing boat as it began to sink in rough seas off the Nantucket coast. The young, inexperienced crew of the fishing boat scrambled to the bow as the stern began to sink. Huard maneuvered his inflatable close to the vessel's hull and tried to calm the panicked men, coaxing them to jump from the sinking boat to the inflatable. Just then the ***Aristocrat*** rolled, hitting Huard's boat. The terrified fishermen lept into the sea, but Huard remained calm, quickly moving his boat away from the wildly pitching vessel, and picking the seven men from the sea. Moments later, the ***Aristocrat*** sank.

The men and women of Coast Guard Marine Safety Office (MSO) Galveston were saluted for their accomplishments during two major pollution incidents, mere weeks apart. The first involved the oil tanker ***Mega Borg***, carrying over 38 million gallons of crude oil. It erupted into flames on June 8, 1990. During the critical early hours of this disaster, it was MSO Galveston's hard work and dedication that saw through the fire-fighting and clean-up efforts. Over 50 Coast Guard Units and hundreds of personnel from federal, state, local, and private resources were assembled to ensure that the 3.9 million gallons that did escape from the crippled tanker were swiftly contained, with no environmental damage.

Hours after the ***Mega Borg*** case was successfully resolved, the personnel of MSO Galveston were once again put to the test after the vessel ***Shinoussa*** collided with the tank barge ***Apex*** in the Houston Ship Channel. Once again, it was their decisive response that resulted in the complete clean-up of over 600,000 gallons of oil in just 3 weeks.

The Coast Guard Auxiliary celebrated its 50th anniversary in 1991, so it was fitting that Auxiliary member Donald H. Merwin was honored. A former corporate pilot, Mr. Merwin is a 10-year Auxiliary veteran who volunteered over 2,000 hours of service in 1 year alone to the Group Galveston Operations Center. He played a pivotal role as the Operations Duty Officer

during the ***Mega Borg*** fire and ensuing oil spill, and coordinated over 200 search and rescue cases.

Chief Warrant Officer John Kimmel, a full-time Coast Guardsman stationed in Alaska, was honored for his volunteer work as a member of the Disaster Assistance Response TEAM (DART) for the State Department's Agency for International Development. He has volunteered his time to this organization since 1988, but his most impressive accomplishments took place during the summer of 1990. He and three other DART members entered civil war-torn Liberia to provide communications support for humanitarian relief efforts. Once inside the capital city of Monrovia to set up communications links, he and his team members constantly ducked enemy gunfire. He personally put his life on the line, dodging rebel bullets as he installed a critical antenna system on the American embassy rooftop.

Marine Meteorological Services Handbook

In view of the continued increase in recent years, both in the requirements of marine users for meteorological and oceanographic data and products, as well as in the services provided by national Meteorological Services, the president of the World Meteorological Organization's Commission for Marine Meteorology agreed in 1988 to the preparation of a **Handbook on Marine Meteorological Services**. The handbook was prepared based upon information provided by the commission members and the first edition was distributed in May of 1990.

Since the first edition, many updates to the published information as well as many new country entries have been received. Therefore a second edition, available in English only, has been published.

The publication provides information on specialized marine services and their availability throughout the world. A brief summary these services is provided by country. More detail on routine services can be found in WMO Publication No. 9, Volume D—**Information for Shipping**. Further information in specialized services can be obtained from the individual national Meteorological Service, and a contact address is provided at the end of each entry.

The routine services listed include: the total area covered by marine bulletins, the time of issue, the validity period of forecasts and the means by which the bulletins can be received.

Specialized services are also listed, where they are available. Specialized services might include a ship routing service, services to offshore oil and gas platforms, which might provide detailed forecasts of wind, wave height, weather, visibility, air temperature and icing risk, if appropriate. To counter incidents of marine pollution, such as oil spill, detailed forecasts are provided to enable the movement and spread of the pollutant to be predicted. For yacht races, more detailed forecasts for the route of the race are provided than are available in the routine service. Services for deep sea fishing include surface and sub-surface ocean analyses. Special forecasts for hydrofoils, hovercraft and similar vessels are also provided, taking into account their greater sensitivity to winds, waves and visibility. Some of these services may be broadcast, but most are provided by arrangement for a fee. The means by which you can obtain specialized forecasts, other than receiving a radio broadcast, are indicated. Primarily, these include telex and telefax. With telefax, the Meteorological Service may send the forecast or chart or may place the information in the memory of the facsimile machine for query. An indication is given as to whether there is a charge for communication. The current country list totals 53 members, which includes most of the major maritime nations of the world.

This book is available from the World Meteorological Organization on a limited basis. They do not have many copies, but if you have a real need for this general information, they will be happy to send a copy. It is designed mainly for those who have a requirement for specialized forecasts, such as shipping companies, petroleum and drilling companies and yacht racing organizers to name a few. The full title is:

World Meteorological Organziation
Handbook on Marine Meteorological Services
WMO/TD–No. 348, 1991 edition

Send your request to:

Secretary
World Meteorological Organization
Attn: Peter Dexter
Casa Postale No. 2300
CH-1211
Geneva, Switzerland

Foreign Photos for DMA—Or One Picture = 1,000 Words

The Defense Mapping Agency is in need of photographs for Sailing Directions–a unique opportunity to help them and other mariners as well. The new editions of Sailing Directions will require a large number of photographs, particularly of landfall aspects, port approaches, channel entrances and turns, major navigational aids, points, capes, and landmarks, if the objective of substituting photos for text is to be adequately maintained. Photographs in either color or black and white are suitable, **Remember the Planning Guides/ Sailing Directions cover areas outside the United States only.**

Eamonn S. Kneeland

Surface Photography

- Photos should be taken from seaward and close enough so that principal landmarks can be identified.
- Photos should be useful to the navigator in establishing a position or identifying a coastline.
- Prints should be annotated on the reverse side as follows:
  - *position of camera by coordinates or true bearing and distance from a chartered object.
  - *identify principal landmarks, navigational aids or other features, which might be useful to navigator.
  - *Describe color of navigational aids in black and white photos.
  - *Give date, time, stage of tide if known, and additional information that might be useful.

Radarscope Photography

- Give wavelength of radar, height of antenna and range scale in use.
- Give true course and speed, position of ship by coordinates or true bearings and distances from charted object, stage of tide and any other information that might be useful to the navigator.
- Give true bearings and distances to all objects that are suitable for position fixing or important to navigation.
- Give true bearings and distances or otherwise identify all temporary targets, i.e. ships, ghost echoes, etc.

If possible, two glossy prints of each picture are requested. The first photo should be clear and unmarked for final use in a publication. The second can be annotated front or back for use as a working copy. If reproduction facilities are not available, undeveloped negatives with a detailed sketch attached are acceptable.

Aerial oblique views of port approaches and overall harbor facilities are also desired for the construction of Directions Diagrams. These can often be obtained on local post cards, from port pamphlets and promotional material and through advertising media. The forwarding of such views would be of great assistance in compiling and maintaining our new Sailing Directions to meet the needs of the modern navigator. Send photos to:

Defense Mapping Agency
Hydrographic/ Topographic Center
ATTN: MCNN
Washington, DC 20315-0030

Camera Care

Michael Halminski

Consider the marine environment. Not only can it be an inhospitable place for men on vessels, but it can also be devastating on camera equipment. Picture taking sometimes puts me in situations when I need to consider protecting my equipment from blowing sand, water and humidity associated with the marine environment.

Common sense and a few precautions can alleviate many problems. One basic form of protection involves the optics of the lens. Many photographers use a skylight or a UV filter in front of the lens. The filter safeguards it from dirt or scratches, and can easily be replaced or cleaned if anything unexpected happens.

Another problem with lenses involves humidity. The glass optics serve as a good medium for fungus growth. If one inspects an affected lens closely, this appears as fine spidery looking lines. The best way to deal with this is maintenance with some lens cleaning fluid and lens tissue. If at all possible, store the equipment in a climate controlled room, or an airtight box with a drying agent like silica gel. Fungus will often grow on the interior optics of the lens. In this case, it might be worthwhile consulting a repair shop. By the way, film is also an excellent medium for fungus growth. Your negatives and slides can be permanently damaged over a period of time, so it is very important to store these in a humidity-controlled atmosphere.

The degree of camera protection depends on the adversity of the environment. In certain mild instances, a filter may suffice, but when things really begin to blow, other safeguards become necessary. At the very least, if I have subjected my camera to any amount of salt spray, I go over it carefully with a clean damp sponge afterwards.

Under more extreme conditions, some sort of containment may be in order. I have, on occasion, improvised a zip-lock bag over my camera. Used with a hole cut in one end for the lens and sealed with something like electricians tape, this affords some protection from light rain or mist. A fancier, more secure approach to solving the problem is with products similar to those made by Ewa Marine. Their basic hurricane hood for most SLR cameras is under $70, but is not submersible. Their tough, flexible housings range from $60 for a compact camera to $160 for a standard SLR rig. They are completely submersible down to 60 feet.

There are also a variety of all-weather cameras on the market. They are self-contained, reasonably watertight, and can even withstand some amount of submersion. A camera that I have used for years is the Nikonos. Its primary use is in underwater photography, but I have employed it in much of my shooting where an adverse environment is a factor. These cameras are capable of withstanding depths of 160 feet and I have heard of them being used in excess of 200 feet. Not much can hurt them as long as the sealing O-rings are well maintained. After using mine, I just rinse it off in fresh running water.

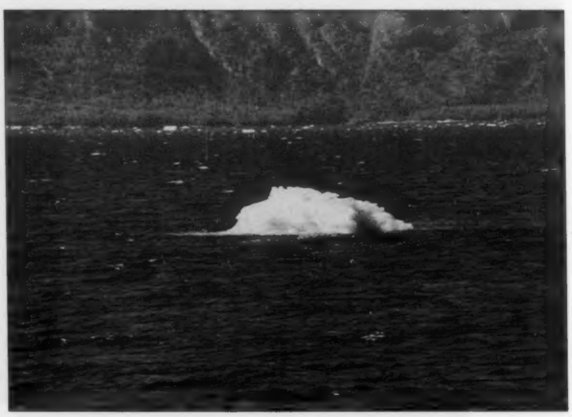
By taking a few precautions with your equipment, you can open up some interesting picture-taking opportunities that would otherwise go unrecorded. The ocean, it seems, can be most dramatic when the conditions get rough.

This shot of a surfer (next page) was made with a Nikonos camera while swimming in the surf. It is always a good idea to have the film developed as soon as possible, particularly when exposed to humid conditions. The Halloween Storm of 1991 provided photographic opportunities up and down the East Coast. The shot (lower right) shows what the surf was like along the Outer Banks of North Carolina on the 30th of October. Both photos are by Michael Halminski.

*Captain Russ Kneeland of the **Kaiulani**, a long time reader of the Log, frequently sails the South Pacific Ocean and was kind enough to share some dramatic shots of these voyages. The photographs were taken by his son, Eamonn S. Kneeland, while his other son, Mike, handled the video taping. In the upper left, the **Kaiulani** is seen anchored at Fatu Hiva in the Marquesas Islands. A squall (upper right) is observed over Tongareva Lagoon in the Northern Cook Islands, while below, the **Kaiulani** beats northward from Pitcairn Island on the long way home to San Diego. On the next page (upper) is a view of Moorea (Society Islands) at sunset from Papeete 12 miles away. The lower photo is the magnificent island of Rapa at the southwest end of the Tubai Islands (French Polynesia).*

Novak's Golden Eagle

Bob Novak



During January and February 1991, I was onboard the training ship ***Golden Eagle***, with Captain Keever in command. On February 10th we departed Valparaiso, Chile, for Punta Arenas via the Inland Waterway. Pilots for the passage were Captains F. Vargara and H. Hunez. We had fair weather with the barometer at 1016 mb. During the day the barometer continued to rise as high pressure approached from the west while we headed south. The wind continued to increase in velocity to about 35 knots by afternoon. According to the pilots a local rule of thumb is: wind will increase during the day, however if it does not increase during the night, it will be even stronger the next day.

On the 11th, the weather was fair, and the barometer still rising, while we were watching a weather system to the west. Fronts were moving at 15° longitude each day between 45° and 60°S. The ship experienced a strong tidal influence of about 0.7 knot about 45 nautical miles offshore. On the 12th, fair weather continued with a good southwest swell as we approached the Golfo De Penas during late afternoon. We spotted eight blue whales in the gulf. We entered Canal Wide early on the 13th where the Sailing Directions warned that passage is often impeded by drift ice from Seno Eyre. This might also include Seno Penguin, where there are glaciers at the head and fast ice across its mouth during the summer. The ship approached Seno Penguin by mid morning and lenticular clouds were observed (top right). We spotted some

bergy bits during our passage (bottom page 42), and left Seno Penguin by mid afternoon as the barometer began to fall. By late in the day, it clouded over and a line of well-defined rain showers moved over the ship and headed eastward into the snow-covered mountains at about 45 knots (above left). By daylight on the 14th we were in the Estrecho de Magallanes and the wind was easterly at 20 knots, which is unusual at this latitude (53°S). A low pressure center passed to the north and the barometer was at 980 mb. By late afternoon we were anchored off Punta Arenas and were able to enjoy a beautiful sunset (above right).

WSFO Chicago is on the Air

WSFO Chicago initiated two new media projects in 1991. The first was a 4 ½ minute tornado Awareness Video that aired on 15 cable access networks in the Metro area, reaching 110 communities. The Video incorporates actual tornado photos, cartoon characters, a written text and voice-over depicting the various Tornado Safety Rules. NWS personnel Herb Hoffman and Bob Collins were co-producers of the video and worked closely with Chicago Access Corporation in its development.

Cable Access invited the National Weather Service to produce a weekly live interactive 30 minute t.v. show called Hot Line 21. The NWS agreed to a 13 week run in which members of the staff acted as hosts, guest experts and studio technicians. Numerous activities and a lot of work go into the production of such a show.

Viewers are encouraged to call in with questions pertaining to the main topic for that week or with any weather-related questions. Thus far 16 shows have been aired with 14 different members of the Chicago staff participating. Some of the topics included Illinois Tornadoes, Marine Weather, and How Thunderstorms and Tornadoes Develop. The weather hot line has become so popular that it has been extended for another 12 weeks and may continue into 1992. The program has developed quite a following and averages six calls per 30 minute show. Tapes are being made and distributed to other Cable Access Networks in the Metro area. There is also a demand for the programs from the Educational and Emergency Service communities.

Annual Outstanding Observing Award, 1990

Bob Collins, PMO Chicago, also had the privilege of awarding a plaque to the tug ***Triton*** for its outstanding weather observations during 1990. Below, Captain Gary Schmidt (right) and Collins do the honors. Schmidt and his crew took over 900 observations. Not in the picture, but sacked-out after a rough lake crossing, is Bill Brett.

Getting to Know Your PMO

Bob Novak, PMO San Francisco

MWL: How long have you worked as a PMO?

Bob: I have been assigned as the Port Meteorological Officer for the San Francisco Bay Region since June 1989. The Bay Region consists of the ports of San Francisco, Redwood City, Alameda, Oakland and Richmond all located around San Francisco Bay. Cargo handling capability includes container, roll-on/roll-off, break bulk and liquid bulk. There is also a 350 mile expanse of water that forms the upper and inner bays of the Region, including the San Pablo and Suisun Bays and the Carquinez Strait. This area is sprinkled with ports and is the center of one of the largest industrial complexes in the United States. Except for the Port of Benicia each terminal serves a specific industry. There are two additional deep water ports that I consider part of the Bay Region. The Port of Stockton, about 75 nautical miles east of the Golden Gate Bridge, is a major transportation center for the agricultural industry of the Central and San Joaquin Valleys. Also, Sacramento, which is located about 95 nautical miles east of the Golden Gate Bridge, handles a variety of commodities such as rice, grains, feed, fertilizers, chemicals, wood chips and logs. Additionally, I have visited all harbors and small ports from Eureka in Northern California to Port San Luis (San Luis Obispo) located on the central California coast. I travel about 13,000 miles per year visiting between 800 and 900 ships.

MWL: That answers my next three questions. What type of work were you involved in before?

Bob: Since 1958 I have been working in the field of meteorology in one way or another. I began with the U.S. Navy and had a variety of assignments that afforded my family and me the opportunity to live on all three coasts of the U.S. plus Hawaii and Okinawa. I have also visited five of the seven continents and sailed six of the seven seas. I was stationed on 24 different ships, most of these from 1972-76. The Navy also afforded me the opportunity to be shot at, bombed, gassed and nuked. I also worked for a brief time, moonlighting, for Ocean Routes. After retiring in 1979, I earned a degree, while working as a private contractor taking upper-air/balloon soundings. After college, I went to work for the National Weather Service on Johnson Island in the Pacific. After 2 years and 2 months too long, I transferred to Colorado Springs, Colorado. During the 1972-76 period, in between ships, I was acted as a PMO in San Diego.

MWL: Bob, catch your breath, while we ask you about your educational opportunities as a PMO.

Bob: Right now my educational work involves three areas. About once every 3 to 4 months I visit one of the many boating skills and seamanship courses that are offered by the 11th Coast Guard District, North Region. I talk about local weather and weather safety on the water. Also, with the Coast Guard Auxiliary, about once a year, I do a 30 minute talk/interview on Public Cable Television. I usually pick one area of the Bay Region and talk about the local weather hazards. Another educational opportunity comes aboard the ***T.S. Golden Bear***, on her annual training cruise. The vessel belongs to the California Maritime Academy (CMA), one of five state maritime academies. This is a 4-year college dedicated to the career development of licensed Deck and Engine officers for the U.S. Merchant Marine and Merchant Marine Naval Reserve. This is a great opportunity to get the message across about the importance of ship weather observations and, at the same time, talk about the NWS and its products as well as teaching some practical meteorology.

MWL: Tell us about your family.

Bob: My wife Barbara and I have been married for 32 years. We have five children, four boys and a girl.

Our oldest is an Electronic Engineer working in Colorado Springs. Son number two, works at the Air Force Academy in Colorado Springs as an equipment repairman. Son number three is a printer, while son number four is a catering manager for Holiday Inn. Both live in Fort Collins, Colorado. Our daughter has taken up journalism as a career and lives in Sacramento, California.

MWL: Besides the obvious, what are your hobbies?

Bob: Traveling and photography. I carry a camera with me most of the time. There is always something to photograph. My sons are hunters, I also hunt, but use a camera instead of a gun. The same skills are involved, but what I shoot, I do not have to carry out, skin or gut, and I do not need a license. I let them do all of that and they keep my freezer full. I also enjoy fishing and reading.

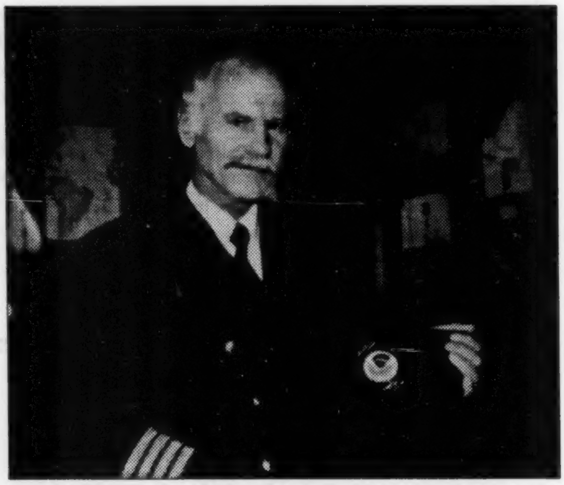
MWL: Do you live close to work?

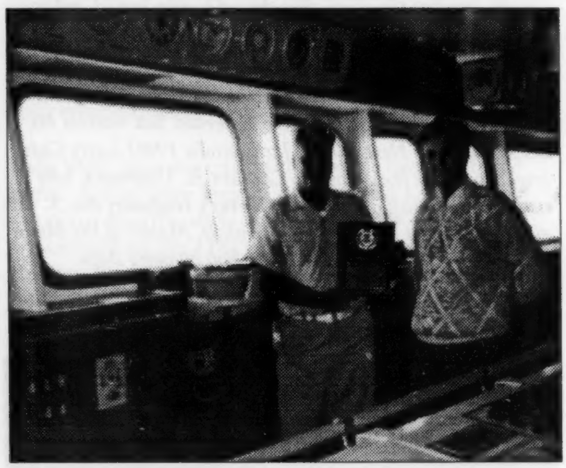
Bob: No, I travel 70 miles a day, round trip. That amounts to over 15,000 miles, with an additional 13,000 miles after I get to work. Add 3,000 to 4,000 miles of recreational driving. If you figure in the mileage I log on the ***Golden Bear***, travel totals about 50,000 miles a year give or take a few. Maybe I should take up *just being there* at home as a hobby.

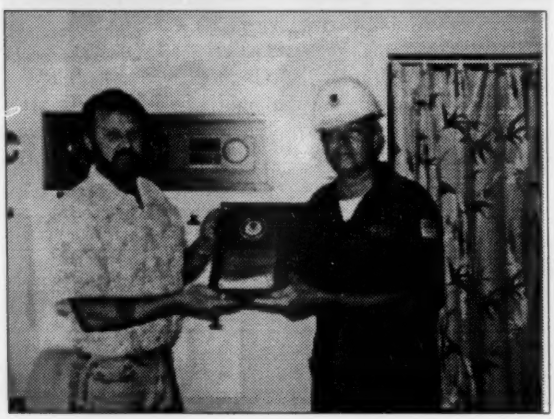
Annual Outstanding Observing Awards, 1990

The awards for outstanding ship weather observations for the 1990 season continue from last issue. These nominations are made by the PMO's, based upon the quality and quantity of observations taken aboard the vessel. Congratulations to this year's recipients. Below, Captain Vineet K. Kapoor, Master of the ***Emerald Sea*** *receives his vessel's award. Next to him, Jacksonville PMO Larry Cain (right) presents the plaque to Captain H. Umemura, who accepted on behalf of the M/V* ***Century Highway No. 5***. *At right is Captain William P. McAuliffe, Master of the* ***Moku Pahu***. *The* ***Moku Pahu*** *is one of Bob Novak's ships.*

Annual Outstanding Observing Awards, 1990







At top, left Ray Brown, PMO Norfolk presents award to QM1 Guy McNabb for the USCGC ***Northland,*** *whose CO is Captain Steven Waldenn. Accepting the plaque on behalf of the* ***Sea Trade*** *was Captain Walter Schenk (top right). Another Ray Brown vessel is the NOAA Ship* ***Ferrel.*** *Accepting their award (middle left) are, from left to right, ST William C. Smith, LCDR John M. Tokar (CO), SS Carlyle D. Lewis and OS Calvin Johnson. Missing was BGL Robert T. Linton. At middle right, Captain H. Blum (left) Master of the M/V* ***Puritan*** *displays the plaque presented by New Orleans PMO Jack Warrelmann. Captain Jan Kummernes of the* ***Sea Wolf*** *(left) shows his award from Jacksonville PMO, Larry Cain (right).*

Cape Hatteras Lighthouse

by
Gene Furr

San Francisco Seaquake

Larry Fosgate
Second Officer

In reference to Ensign's Schubert's letter on seaquakes, I too have experienced that phenomenon, although I did not know the term. While aboard the USNS ***Walter S. Diehl***, an MSC oiler, off the coast of Pt. Reyes on an evening in October [1990], we felt a violent shaking of the hull, the origin of which was well known from the call of the San Francisco VTS operator on Yerba Buena just seconds before. The same quake which caused the damage to the highways and bridges of the East Bay had gone to sea and under our ship about 5 nautical miles south of Pt. Reyes in 300 feet of water.

The bridge AM receiver had been tuned to the station which would carry the World Series, but when it was switched on, no signal was heard on that frequency. The only radio we were receiving then was on the bridge-to-bridge VHF. Traffic on the VTS channel was very serious, since it was also instantaneously reporting that the Bay Bridge had collapsed and that there might be casualties.

A look over my shoulder astern confirmed that a major quake had taken place as loose material was falling into the ocean from one of the bare cliffs near Double Point.

On the ship, the Captain immediately phoned the bridge to determine what had caused the violent motion, which was not unlike a stranding. Shortly after the conversation with the captain, the crew was advised of the quake in the Bay Area and that the Bay Bridge had collapsed, all that was known at that time.

Having sailed for many years in several earthquake zones, this was truly the only time that I had experienced a seaquake. Had anyone, prior to that time told me of such an occurrence, I would have been very skeptical about its possibility.

Our return the next day to the Naval Supply Center in the stricken area of Oakland confirmed the vast devastation that had been experienced ashore. Buildings five stories high and a city block long had been raised 6 to 9 inches in relation to the soil material around them, streets and sidewalks were spider-webbed with cracks and heaves, and even a flagpole was bent over at the base on one of the warehouses.

There was no damage to the ***Walter S. Diehl*** from the motion, which probably did not cause any undo stress upon the hull while afloat and with encumbrances.

Thanks to Larry for taking the time to write about his experiences in the Great San Francisco Earthquake of 1990. It is always most valuable to hear about weather and environmental phenomena in a first hand account. Such accounts formed the basis for modern marine meteorology as well as many other sciences. Nowhere are they more valuable than at sea, where we are still seeking many answers to the interaction between the sea and air. While satellites are a valuable tool, they can never take the place of observations from the mariner. At the same time a written account of an unusual occurrence at sea brings the experience to life for other mariners as well as for those interested in the marine environment. We always welcome these accounts.

editor

Questions, Codes and PMOs

Martin S. Baron
National Weather Service

I've received many questions about the page-sized color sea state photographs in chapter 3, pages 3-17 through 3-29 of the new National Weather Service (NWS) Observing Handbook No. 1. The first 12 photographs, which depict conditions corresponding to Beaufort Force 0-11, were taken by Observers aboard Canadian Weather Ships ***Vancouver*** and ***Quadra*** at Ocean Weather Station PAPA (50° N, 145° W) during 1976 , in the northeast Pacific Ocean; this station is now closed. The 13th photograph, a rare picture of sea state conditions during a hurricane (Force 12), was supplied by Captain Gordon Mackie, Marine Superintendent of the British Meteorological Office, and was taken by an observer aboard a vessel in the British VOS program (vessel name not available at this time). Special permission was needed from the Department of Commerce to use the color photographs, because of the higher printing costs for multi-colored inks. We think the color photos are well worth the extra cost.

Each number, or Beaufort Force, represents a small range of wind speeds, which produces a characteristic appearance of the sea surface (state of the sea), under steady state conditions. Only a small number of VOS have anemometers to measure wind speed--the vast majority of vessels estimate wind speed by observing the state of the sea.

The NWS also has a sea state wall poster with photographs of Force 0-11 conditions, available from your Port Meteorological Officer (PMO). Good sea state photos are hard to come by, and I'm always anxious to receive them for possible inclusion in official publications. If you have any to spare, please send them to me in Silver Spring, Md. (address on the inside back cover).

Reminder – Transmit INMARSAT Reports in 30 Seconds or Less

Please make every effort to complete the transmission of your INMARSAT weather report in 30 seconds or less, to reduce costs paid by the NWS (the great majority of vessels are currently doing this--thank you). If you occasionally require more time, please do not exceed a transmission time of 1 minute. Prepare the Weather Report For Immediate Transmission, WS Form B-80 **before** you connect with the Coast Earth Station. This form consolidates the coded weather message for easy reading and handling.

Over 60% of weather reports received by the United States are now carried by INMARSAT. Most of the remainder are morse code reports relayed through the United States Coast Guard. Commercially operated shore radio stations also handle significant numbers of reports. Ship weather reports from overseas radio and INMARSAT stations are received through the Global Telecommunications System (GTS), a dedicated meteorological communications network carrying observations, forecasts, and guidance products worldwide.

More on Coding Section 0 (groups 1–5) of the Ship's Synoptic Code

Because of it's importance in ensuring the arrival of your weather message at the NWS, I'm reviewing section 0 of the synoptic code for a second time. Please pass this article around so that all officers participating in the weather observation program aboard your vessel see it. Some ship weather reports are needlessly scrapped every day because of coding errors or omissions in section 0 (the first 5 code groups starting with the BBXX indicator). There is no meteorological or oceanographic data in this section. It identifies the message as a ship's weather report, and locates your vessel in time and place. **Never slash out data or omit any groups in section 0–it's a mandatory section to be included in every weather report.** If you do not have a call sign, or don't want it disclosed, insert SHIP instead of your call letters in the D.....D group. Only data in sections 1 and 2 (groups 6–21 and ice data) can be omitted, when not available, in two ways, 1) by using the slash mark (/), or 2) by omitting entire groups from the message (never transmit a group as /////). Exception: the first group in section 2, $222D_sv_s$ must be included whenever any section 2 groups (marine and ice data) are present.

Synoptic Code Section 0 (report identification, ship position data)

BBXX D.....D $YYGGi_w$ $99L_aL_aL_a$ $QCL_oL_oL_oL_o$

Definitions

BBXX	Ship's weather report identifier
D.....D	Ship's radio call sign.
YY	Day of the month (UTC)
GG	Hour of the observation (UTC)
i_w	Wind measurement indicator
99	Position groups indicator
$L_aL_aL_a$	Latitude
Q_c	Quadrant of the Globe
$L_oL_oL_oL_o$	Longitude

The BBXX indicator is always the first group of the weather message, and is the international identifier for a ship's weather report.

D.....D, your radio call letters, can be up to seven characters long. **If your call sign is less than 7 characters, do not use slashes or periods to fill in space. Transmit your actual call sign characters only.**

YY and GG, the day and observation hour in Universal Time Coordinated (UTC), are coded with two digits each–YY as 01, 02, 10 etc; GG as 06, 09, 12 etc. For GG, use the time the barometer is read rounded off to the nearest whole hour UTC, e.g. both 1152 and 1208 would be coded as 12.

i_w, the wind measurement indicator, is coded as 3 for estimated wind speed, and as 4 for anemometer measured wind speed.

99, the ships position groups indicator (position is identified by latitude, quadrant, and longitude), always precedes the latitude, $L_aL_aL_a$. Latitude is indicated in whole degrees and tenths of a degree, with the decimal point left out i.e. 50.8 degrees is entered as 508; 25.0 degrees is entered as 250 . For values less than 10 degrees, the first L_a is coded as zero i.e. 6.2 degrees is entered as 062. To convert minutes to tenths of a degree, divide the minutes by six and disregard the remainder i. e. 35 minutes is 5 tenths; 57 minutes is 9 tenths.

Q_c, the quadrant, is coded as either 1, 3, 5, or 7, according to your latitude and longitude. If your latitude/longitude are north and east, respectively, code Q_c as l; if south and east, code Q_c as 3; if south and west, code Q_c as 5; if north and west, code Q_c as 7.

$L_oL_oL_oL_o$ (longitude), like latitude, is reported in whole degrees and tenths of a degree. As for latitude, convert minutes to tenths by dividing minutes by six and dropping the remainder. For values less than 10 degrees of longitude, the first two L_o's are coded as zero. For values less than 100 degrees of longitude, the first L_o is coded as zero. Examples: 2 degrees 27 minutes longitude is entered as 0024; 25 degrees 47 minutes is entered as 0257; 163 degrees 56 minutes is entered as 1639.

Please see page 46 of the Fall 1991 Mariners Weather Log, or the July 1991 edition of NWS Observing Handbook No. 1, Chapter 3, pages 3-1 through 3-7, for more information about section 0.

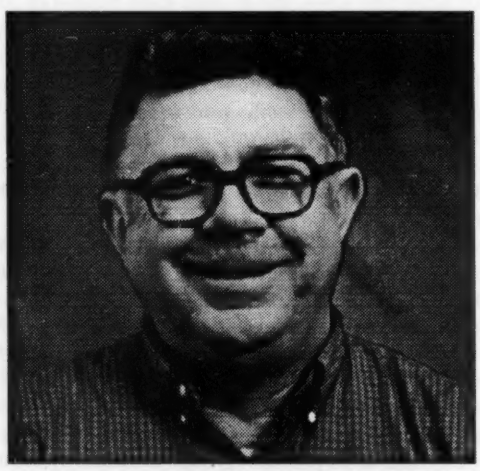
Pete Connors Retires

Peter Connors, PMO in Miami, Florida, retired in January, 1992, after having completed 37 years of government service. Pete has been a PMO for the past 14 years in Port Arthur, Texas, Jacksonville, Florida, and Miami, Florida. He came to work for the NWS in 1958, and was assigned to the Atlantic Weather Patrol. He participated in the Indian Ocean Expedition for 2 years, and spent 1 year as a scientist aboard the Antarctic Research vessel *Eltanin*. Before coming to the NWS, Pete spent 5 years in the U.S. Air Force as a weather observer.

We wish Pete well in his retirement, and success in his leisure activities.

Reduced Size WS Form B-81, Ship's Weather Observations

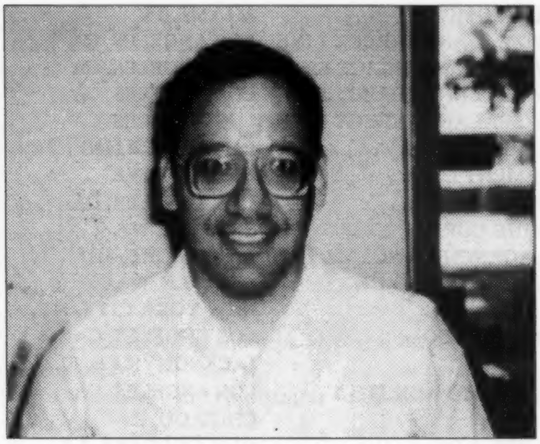
Many of you are now using the new smaller Ship's Weather Observations Form (pad with yellow cover), dated 5-91. The form was reduced 50% in length to ease handling, by adding a fold just before the start of synoptic code section 2 (before the $222D_sv_s$ group). The high speed wind group, 00fff, was also added to the form, in code section 1. When your wind speed is less than 99 knots (almost always), wind speed is reported using the Nddff group, and group 00fff is omitted from the weather message. Unless you're experiencing a very high speed wind (99 knots or greater), the old version of Form B-81 can still be used. **Please do not discard these–use them up before switching to the new version.**



New PMO For Newark

Martin Bonk is the new PMO in Newark, New Jersey, replacing John Warrelmann who transferred to the PMO position in New Orleans. Marty has over 30

years of experience in weather observing and forecasting, gained with the Navy and Naval Reserve from 1957–1988, with the Naval Oceanographic Command in 1988, and with the NWS since April of 1990. He attended Aerographer's Mate Class "A" school for observers and Class "B" school for forecasters. He was stationed on many different vessels throughout his naval career. He is married with two daughters and two grandsons, and lives in Forked River, New Jersey.



New PMO in Miami, Florida

Steve Fatjo (pronounced like it's spelled "Fat-jo") is the new PMO in Miami, Florida, replacing Pete Connors who retired in January, 1992. Steve has a B.S. degree in physical science from Old Dominion University and dual master's degrees in meteorology and oceanography from the Naval Postgraduate School in Monterey, California (1985). He also attended the U.S. Naval Academy in Annapolis, MD for 2 years. He was commissioned an ensign in the U.S. Navy in 1981, worked as a weather forecaster for a year, and was sent to be Executive Officer in oceanography aboard the USNS ***Bowditch*** for 12 continuous months. He then served as a typhoon duty officer at the Joint Typhoon Warning Center in Agana, Guam. In 1988, he was the Ship's Oceanographer aboard the USS ***Tarawa*** (LHA-1), spending most of the next 2 years at sea off San Diego, CA. In 1990 he transferred to the Defense Mapping Agency Combat Support Center, and spent 6 months in Bahrain supporting Desert Shield/Desert Storm operations, commanding map distributions to allied combat forces in the Persian Gulf. This is Steve's first position with the NWS.

New Recruits October – December, 1991

PMO's recruited 45 vessels for the Voluntary Observing Ship (VOS) program during October, November, and December of 1991. Thank you for joining the program. You are now part of a select group of over 7000 vessels from 49 countries that report coded weather messages using the World Meteorological Organization code FM 13-IX, the Ships' Synoptic Code. The NWS VOS program has almost 1700 vessels, with over 10,000 ship's officers participating as observers annually.

Your observed data is absolutely essential for synoptic weather analyses. Without it, weather forecasting would not be possible. Over land areas, there are elaborate observation networks to meet data requirements. Observations are so important that many land stations operate 24 hours per day, and report weather hourly (using code very similar to the ships' code). Over the oceans, except for a small number of very costly Data Buoys and Ocean Weather Stations, meteorologists depend on moving ships for data. Satellites are good at identifying cloud development and movement, and help locate atmospheric disturbances and tropical weather systems such as hurricanes. However, satellites are not able to measure the important elements provided by surface based observations, and do not record local conditions. This information can only be obtained from equipment and/or observers located at the surface of the earth or sea.

Remember, the worldwide weather reporting schedule for VOS is four times daily--at 0000 0600, 1200, and 1800 (UTC), and every 3 hours when within 300 miles of named tropical storms or hurricanes.

The United States and Canada have a special three hourly coastal waters reporting schedule, from within 200 miles of the United States or Canadian coastlines, including the coasts of the Hawaiian Islands and Alaska. Three hourly reports are also requested from the Great Lakes. Send Special or Storm reports at any time, when appropriate. The reporting schedules are indicated on pages 1-3 and 1-4 of NWS Observing Handbook No. 1.

NATIONAL WEATHER SERVICE VOLUNTARY OBSERVING SHIP PROGRAM
NEW RECRUITS FROM OCT 1,1991 TO DEC 31, 1991

NAME OF SHIP	CALL	AGENT NAME	RECRUITING PMO
BLUE ICE	XYFX	COOL CARRIERS	LOS ANGELES, CA
BRAVADO	KNFH	MASTER	SAN FRANCISCO, CA
BUNGA KESIDANG	9MYJ	MALAYSIAN INTERNATIONAL SHIPPING	LOS ANGELES, CA
CAPE ISABEL	KLHR	AMERICAN PRESIDENT LINKES	SEATTLE, WA
CHEVRON LONDON	ELYX	CHEVRON SHIPPING CO	SEATTLE, WA
CHIQUITA CINCINNATION	C6JC7	BANNANA SUPPLY COMPANY	MIAMI, FL
DIRECT FALCON	LAC04	AUSTRALIA-NEW ZEALAND DIRECT LINE	LOS ANGELES, CA
DIRECT KEA	LAJH4	AUSTRALIA NEW ZEALAND DIRECT LINE	LOS ANGELES, CA
DIRECT KIWI	LACP4	AUSTRALIA-NEW ZEALAND DIRECT LINE	LOS ANGELES, CA
DIRECT KOOKABURRA	LAJI4	AUSTRALIA-NEW ZEALAND DIRECT LINE	LOS ANGELES, CA
EDYTH L.	C6YC	CAPES SHIPPING AGENCIES	BALTIMORE, MD
ENVOYAGER	9VHH	OW SHIP MANAGEMENT LTD.	NORFOLK, VA
ESPERANCE	XYEE	WING TAK SHIPPING AGENCY	LOS ANGELES, CA
EVER GUARD	3ESL2	EVERGREEN MARINE CORP	SEATTLE, WA
FRANCES L.	C6YE	CAPES SHIPPING AGENCIES, INC	BALTIMORE, MD
GREEN ELLIOTT	3EWC	INTERNATIONAL SHIPPING CO INC	SEATTLE, WA
GRETCHEN ROLLWAGON	CODEAN	SEA	NEW YORK CITY, NY
HAMBURG STAR	3FYW2	WILLIAMS DIMOND AND CO.	LOS ANGELES, CA
JO BRIED	LAVQ2	JO TANKERS B.P.	JACKSONVILLE, FL
JOHN V. VICKERS	WTEC	USC - MARINE SUPPORT FACILITY	LOS ANGELES, CA
LAKE GUARDIAN	WA09082	E.P.A.	CHICAGO, IL
MARITIME LIGHT	9VET	INC SHIPPING CO.PTE. LTD.	NEW ORLEANS, LA
MERCHANT PRELUDE	C6KM8	V. SHIPS (UK) LTD	SEATTLE, WA
MONTERREY	PGAF	TRANS-AMERICA SS AGENCY	LOS ANGELES, CA
OLIVE ACE	ELKD7	WILLIAMS DIMOND AND CO	LOS ANGELES, CA
PIONERO	DUDH	CRIMS. LINE LTD.	SEATTLE, WA
PRINCE OF OCEAN	3EC09	TAKAI SHIPPING CO. LTD., T.B.R. BLDG.	SEATTLE, WA
STAR LEIKANGER	LAPM2	STAR SHIPPING (NY) INC.	HOUSTON, TX
TAI HE	BOAB	NORTON LILLY INTERNATIONAL, INC.	LOS ANGELES, CA
TAI SHAN	BKFS	SINCERE NAVIGATION CORP.	NORFOLK, VA
TOLLY MOORE	WUV722	MARIMED FOUNDATION	HONOLULU, HA
USCGC GALLATIN	NJOR	COMMANDING OFFICER	NEW YORK CITY, NY
USCGC MARIPOSA	NODP	COMMANDING OFFICER	SEATTLE, WA
USCGC MATINICUS	NDIS	COMMANDING OFFICER-QM SECTION	NORFOLK, VA
USCGC POLAR SEA	NRUO	COMMANDING OFFICER	SEATTLE, WA
USNS GLOVER	NFEN	MILITARY SEALIFT COMMAND	NORFORLK, VA
USNS JOHN MCDONNELL	NJMD	MILITARY SEALIFT COMMAND, ATLC	NEW ORLEANS, LA
USNS KANAWHA T-A0 196	NPTD	COMMANDING OFFICER	NEW ORLEANS, LA
USNS LITTLEHALES	NLIT	COMMANIDNG OFFICER	NEW ORLEAND, LA
USNS VICTORIOUS	NVIC	MILITARY SEALIFT COMMAND	NORFOLK, VA
USNS WALTER S. DIEHL	NWSD	COMMANDING OFFICE	SAN FRANCISCO, CA
VALIANT	WXYZ	SEALIFT INC.	NEW ORLEANS, LA
VERA ACORDE	3EAG4	KERR STEAMSHIP CO.	SEATTLE, WA
WECOMA	WSD7079	OSU MARINE SCIENCE CTR	SEATTLE, WA
WESTERN FUTURE	DVTY	FUYO KAIN CO. LTD. DOJIMA FUYO BLDG	JACKSONVILLE, FL

Getting it Right

Forrest Gray
NWS, Silver Spring

If the Captain wants to know what you have been doing lately.....

and you are responsible for ship weather reports...

give this a fast read, it may help.

Over 30,000 reports a month are received by the National Weather Service (NWS) of the United States. The reports are processed (quality controlled) before use by the National Meteorological Center and retransmission to other users (ship routing firms etc.). If your reports are identified by the quality control process as having errors in identification or location, they may end up in the *bit bucket*.

The quality control process, keys on the "99" code group. Forward from the 99 group, the longitude, latitude, and quadrant are checked. Backward from the 99 group, the date/time and the presence of a radio call sign are checked. If these items are within tolerance and not garbled the report is accepted.

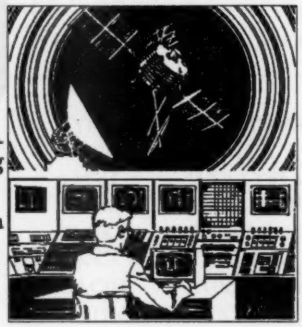
Your help in providing these reports is appreciated, but beyond this your help is critical in making sure the Call Sign and first three code groups (Call Sign, $YYGGi_w$, $99L_aL_aL_a$, $Q_cL_oL_oL_o$) are correct. Summaries by ship Call Sign are used internally to check bills for communication costs, credit ships in the Voluntary Observing Ship program and other needs. It is easy to see from these summaries that communication glitches as well as coding problems affect the first four groups of a report. Here are some samples with both **readable** (*) and unreadable call signs:

Call Sign	Reports	Call Sign	Reports
***BDMP**	**13**	TR3	3
BREMEN/	1	ULLSWAT	12
***BSBZ5**	**1**	V	1
BU	1	***VCDT**	**59**
BXX	1	***CGCX**	**39**
X	65	***GYYP**	**20**
XC6YC	7	H	1
XELJP8	3	HHWJRG	1
XKRHL	6	HZ	1
***HZLL**	**4**	22214	9
..3EJ7	1	3////	16

By international radio regulations, call signs can be from 4 to 7 characters in length. Various combinations of letters and numbers, such as AA1111, AAAA1, AAAA, A1AA1 or 1AAA, are possible. **The Call Sign must follow the BBXX group** and be separated from other groups by a **space** preceding it and following it. It is hoped that this kind of information will be useful to those taking ship weather reports. Comments are welcome. Please send them to:

Mariners Weather Log Radio Tips
NODC, NOAA
1825 Connecticut Av. NW
Washington DC 20235

U.S. Coast Guard Request



The U.S. Coast Guard Communication Station, Portsmouth VA/NMN, SELCALL 1097 has added two additional frequencies to furthr assist the Merchant Fleet in accessing the HF automated TELEX (SITOR) system. The following is a complete list of frequencies and times available:

NMN Assigned Freq.	Ship Assigned Freq.	Times
4272.0	4174.0	on request
6316.0	6264.5	2300–1100z
8428.0	8388.0	24 hours
12595.5	12490.0	24 hours
16819.5	16696.5	24 hours
22389.5	22297.5	1100–2300z

note*
Carrier or dial frequency is located 1700Hz below the assigned.

There are no charges for the below command services. A reminder to all users of AMV+ and OBS+: please ensure theat proper formatting is used. Your message is being relayed automatically without operator review. If you have any questions or require assistance contact this station using the command OPR+.
The following is a list of available commands with explanation and NMN response codes:

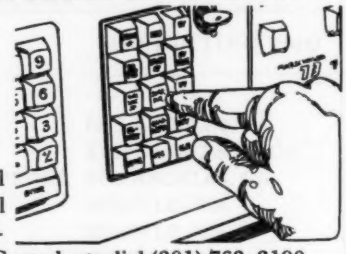
Command	Explanation	NMN response
OBS+	Weather observations	MOM11+ MSG+
AMV+	AMVER messages	MOM01+ MSG+
MED+	Medical emergencies	MOM07+ MSG+
URG+	Shipboard/Navigational emergencies	MOM20+ MSG+
TFC	Any U.S. Govt. Class A or B message	MOM16+ MSG+
VES+	VESREP for U.S. fisheries	MOM13+ MSG+
BRK+	Disconnects communications	
OPR+	Operator assistance	
HELP+	List of Commands	

note*
The six commands (RT1, MRK, FREQ, MAN, TGM, TEST) listed in the help command are not recognized for government use and will result in an error if access is attempted.

In an effort to better our service to the Merchant Fleet, we welcome comments and recommendations. Please address all mail to:

Commanding Officer
U.S. Coast Guard CAMSLANT/NMN
C/O NSGA Northwest
Chesapeake, VA 23322-2598

New Dial and Modem Service for Ice Charts



The Navy/NOAA Joint Ice Center (JTC) has a new dial in telefax line for all of the JTC ice products. To obtain JTC products dial (301) 763-3190 from a touch tone fax machine and follow the voice prompt menu. After listening to the menu just enter the numerical command from the key pad to receive the desired chart. A products list and instructions can be obtained by dialing in and pressing one (1) on the key pad then press your start button at the sound of the start tone.

For users who need digital ice data, the Joint Ice Center now has an Omnet bulletin board called SEA.ICE. The type of data include digital ice edges for both the Northern and Southern Hemisphere as well as weekly updates on iceberg locations in the Antarctic.

All Joint Ice Center products are also available via direct mail service from the National Climatic Data Center. For more information call (704) 259-0272 and ask for Mr. Sam McGowen.

GUAM 1, M.I.

CALL SIGN	FREQUENCIES	TIMES		EMISSION	POWER
NPN	4965 kHz	0000-2359@	LSB	F3C	
	5260 kHz	0000-2359*	LSB	F3C	
	10255 kHz	0000-2359*	LSB	F3C	
	12777 kHz	0000-2359@	USB	F3C	
	16029.6 kHz	0000-2359*	LSB	F3C	
	19860 kHz	0000-2359*	LSB	F3C	
	22324.5 kHz	0000-2359@	LSB	F3C	
	23010 kHz	0000-2359*	LSB	F3C	

* GUAM FREQUENCIES   @ JAPAN FREQUENCIES

TRANS TIME	CONTENTS OF TRANSMISSION	RPM/IOC	VALID TIME	MAP AREA
0000/------	84HR PROG BLEND	120/576	1200	3
------/1200	36HR 500MB PROG (WPAC)	120/576	1200	1
0020/1220	36HR PROG BLEND (FSNH)	120/576	12/00	1
0040/1240	36HR SIGNIFICANT WAVE HT PROG (MSNH)	120/576	12/00	1
0100/------	36HR 500MB PROG (WPAC)	120/576	0000	3
------/1300	WPAC SATELLITE IMAGERY (A SECTOR)	120/576	1200	
0115/------	OCEAN GRADIENTS (MON/THU)	120/576		7
	SST ANAL (S) (TUE/FRI)	120/576		8
	SST ANAL (N) (WED/SAT)	120/576		8
------/1315	GFAX WPAC SCHEDULE PART 1 OF 2	120/576		
0135/------	OPEN (MON/THU)			
	SST ANAL (TUE/FRI)	120/576		8
	SLD ANAL (WED/SAT)	120/576		1
	CZ PROBABILITY (SUN)	120/576		1
------/1330	GFAX WPAC SCHEDULE PART 2 OF 2	120/576		
0150/1350	WPAC SATELLITE IMAGERY (A SECTOR/I-J SECTOR)	120/576	00/12	
0205/1205	MICRONESIA SATELLITE IMAGERY (VV/IR)	120/576	12/00	
0220/1420	36HR 300MB PROG	120/576	00/12	3
0235/1435	TROPICAL CYCLONE WARNING	120/576	00/12	
0250/1450	48HR 500MB PROG (WPAC)	120/576	12/00	3
0305/------	48HR 300MB PROG (WPAC)	120/576	12/00	3
0320/1520	FULL DISK IMAGERY (VV/IR)	120/576	02/14	
0335/1535	48HR 700MB PROG (WPAC)	120/576	12/00	3
0350/1550	48HR 850MB PROG (WPAC)	120/576	12/00	3
0405/------	WPAC SATELLITE IMAGERY (I/J SECTOR)	120/576		
------/1605	72HR NOGAPS SURFACE PROG (WPAC)	120/576	0000	3
0420/------	OPEN			
------/1620	96HR NOGAPS SURFACE PROG	120/576	0000	3
0435/1635	PRELIM SURFACE ANAL	120/576	00/12	3
0450/1650	WPAC SATELLITE IMAGERY (A SECTOR)	120/576	03/15	
0505/1705	SIGNIFICANT WAVE HT ANAL (MSEH)	120/576	00/12	2
0525/1725	24HR NORAPS SURFACE PROG (NR)	120/576	00/12	4
0540/1740	36HR NORAPS SURFACE PROG (NR)	120/576	00/12	4
0555/1755	48HR NORAPS SURFACE PROG (NR)	120/576	00/12	4
0610/1810	FINAL SURFACE ANAL (ASEH)	120/576	00/12	2
0630/1830	500MB ANAL (CPAC)	120/576	00/12	5
0645/1845	300MB ANAL (CPAC)	120/576	00/12	5
0700/1900	24HR NOGAPS SURFACE PROG (WPAC)	120/576	00/12	3
0715/1915	36HR NOGAPS SURFACE PROG (WPAC)	120/576	00/12	3
0730/1930	48HR NOGAPS SURFACE PROG (WPAC)	120/576	00/12	3
0745/1945	WPAC SATELLITE IMAGERY (A SECTOR)	120/576	06/18	
0800/2000	850MB ANAL (WPAC)	120/576	00/12	3
0815/2015	TROPICAL CYCLONE WARNING	120/576	06/18	
0830/2030	500MB ANAL (WPAC)	120/576	00/12	3
0845/2045	300MB ANAL (WPAC)	120/576	00/12	3
0900/2100	700MB ANAL (WPAC)	120/576	00/12	3
0915/2115	24HR 850MB PROG (WPAC)	120/576	00/12	3
0930/2130	24HR 700MB PROG (WPAC)	120/576	06/18	3
0945/2145	24HR 500MB PROG (WPAC)	120/576	00/12	3
1000/2200	WPAC SATELLITE IMAGERY (A SECTOR)	120/576	09/21	
1015/2215	PRELIM SURFACE ANAL (WPAC)	120/576	06/18	3
1030/2230	24HR 300MB PROG (WPAC)	120/576	00/12	3
1045/2245	24HR 850MB PROG (CPAC)	120/576	00/12	5
1100/2300	24HR 700MB PROG (CPAC)	120/576	00/12	5
1115/2315	24HR 500MB PROG (CPAC)	120/576	00/12	5
1130/2330	36HR 850MB PROG	120/576	12/00	3
1150/2350	36HR 700MB PROG	120/576	12/00	3

NOTES:
1. BROADCAST CONTENT MAY CHANGE WITHOUT NOTICE DUE TO OPERATIONAL COMMITMENTS OF THE U.S. NAVY.
2. SAMPLES OF PRODUCTS ANNOTATED WITH DATE, TIME, POSITION, FREQUENCY AND COMMENTS CONCERNING QUALITY AND CONTENT ARE SOLICITED. ADDRESS COMMENTS TO:
NAVAL OCEANOGRAPHY COMMAND CENTER
PSC 489, BOX 12
F.P.O. AP 96540-0051 U.S.A.

MAP AREAS:

1	-	60N	035E,	60N	180,	15S	035E,	15S	180
2	-	55N	030E,	55N	180,	45S	030E,	45S	180
3	-	60N	100E,	60N	175E,	EQ	100E,	EQ	175E
4	-	65N	100E,	65N	175E,	10N	100E,	10N	175E
5	-	60N	135E,	60N	150W,	EQ	135E,	EQ	150W
7	-	65N	115E,	65N	180,	15N	115E,	15N	180
8	-	60N	110E,	65N	180,	20N	125E,	25N	155E

(INFORMATION DATED 11/1991)

ANKARA, TURKEY

CALLSIGNS	FREQUENCIES	TIMES	EMISSION	POWER
YMA20	3377 kHz	1610-0500	F3C	5 KW
YMA20	6790 kHz	0500-1610	F3C	5 KW

TRANS TIME	CONTENTS OF TRANSMISSION	RPM/IOC	VALID	MAP TIMEAREA
----- /1240	SURFACE ANAL	90/576	0900	A
0330/------	24HR/36HR 500MB PROGS	90/576	1200	A
0430/1610	SURFACE ANAL	90/576	00/12	A
0500/------	TEST CHART	90/576		
------ /1710	24HR SIGNIFICANT WEATHER PROG	90/576	1200	A
0610/1840	SURFACE ANAL	90/576	03/15	A
0640/1910	500MB ANAL	90/576	00/12	A
0710/------	300MB ANAL	90/576	0000	A
0740/------	24HR SIGNIFICANT WEATHER PROG	90/576	0000	A
----- /1940	200MB ANAL	90/576	1200	A
0810/------	24HR 700MB PROG	90/576	0000	A
------ /2015	300MB ANAL	90/576	1200	A
0840/------	24HR 300MB PROG	90/576	0000	A
0910/------	48HR/72HR 500MB PROG	90/576	1200	A
0940/2152	SURFACE ANAL	90/576	0600	A
1010/------	TROPOPAUSE PROG	90/576	0000	A
1040/------	MAX WIND ANAL	90/576	0000	A

MAP AREA: A - 1:10,000,000 54N 013W, 53N 076E, 18N 007E, 17N 055E

(INFORMATION DATED 07/1991)

HALIFAX, NOVA SCOTIA, CANADA

CALL SIGN	FREQUENCIES	TIMES	EMISSION	POWER
CFH	122.5 kHz	CONTINUOUS	F3C	
	4271 kHz	CONTINUOUS	F3C	
	6496.4 kHz	CONTINUOUS	F3C	
	10536 kHz	CONTINUOUS	F3C	
	13510 kHz	CONTINUOUS	F3C	

TRANS TIME	CONTENTS OF TRANSMISSION	RPM/IOC	VALID TIME	MAP AREA
0001/1201	SIGNIFICANT WEATHER DEPICTION	120/576	12/00	
0015/------	ICE CHART	120/576	LATEST	
0101/------	30HR/36HR 850MB HT/TEMP/WIND PROGS	120/576	18/00	
------ /1301	ICE CHART	120/576	LATEST	
------ /1401	ICE CHART	120/576	LATEST	
------ /1423	18HR/24HR 850MB HT/TEMP/WIND PROGS	120/576	06/12	
0301/1501	500MB ANALYSIS	120/576	00/12	
0315/1515	SURFACE ANALYSIS	120/576	00/12	
0401/1601	WAVE ANALYSIS	120/576	00/12	
0414/1614	12HR SIGNIFICANT WAVE PROG	120/576	12/00	
0428/1628	850MB ANALYSIS	120/576	00/12	
0501/1701	24HR SURFACE PROG	120/576	00/12	
0514/1714	24HR SIGNIFICANT WAVE PROG	120/576	00/12	
0601/1801	18HR SIGNIFICANT WEATHER DEPICTION PROG	120/576	18/06	
0614/1814	36HR SIGNIFICANT WAVE PROG	120/576	12/00	
0701/------	18HR/24HR 850MB HT/TEMP/WIND PROGS	120/576	18/00	
------ /1901	36HR SURFACE PROG	120/576	0000	
0801/------	36HR SURFACE PROG	120/576	1200	
------ /2001	18HR/24HR 850MB HT/TEMP/WIND PROGS	120/576	06/12	
0814/------	NFLD SST (WED&SAT) NS OFA (TUE)	120/576	LATEST	
	NS SST (SUN&THU) NFLD OFA (MON&FRI)	120/576	LATEST	
------ /2014	NS SST (NFLD SST MON, WED, SAT)	120/576	LATEST	
0901/------	SURFACE ANALYSIS	120/576	0600	
------ /2101	NS OFA (NFLD OFA MON, WED, SAT)	120/576	LATEST	
------ /2120	SURFACE ANAL	120/576	1800	
1001/------	36HR SURFACE PROG	120/576	1200	
------ /2201	ICE CHART	120/576	LATEST	
1014/------	BROADCAST SCHEDULE	120/576		
	TEST CHART (TUE-THU-SAT)	120/576		
1101/2301	ICE CHART	120/576	LATEST	

(INFORMATION DATED 06/1991)

PRETORIA, SOUTH AFRICA

CALL SIGNS	FREQUENCIES	TIMES	EMISSION	POWER
ZRO2	7508 kHz	CONTINUOUS	F3C	8-30KW
ZRO3	13538 kHz	CONTINUOUS	F3C	30 KW
ZRO4	18238 kHz	CONTINUOUS	F3C	30 KW

TRANS TIME	CONTENTS OF TRANSMISSION	RPM/IOC	VALID TIME	MAP AREA
0405	ECMWF SURFACE ANAL	120/576	0000	
0430	UPPER AIR ANAL	120/576	0000	
0445	SURFACE ANAL (SHIPPING)	120/576	0000	
0500	FAX SCHEDULE	120/576		
0515	SURFACE ANAL (1) (2)	120/576	0300	
0630	ECMWF UPPER AIR ANAL	120/576	0000	
0710	10-DAY MEAN SEA SURFACE TEMP (4)	120/576	-----	
	10-DAY MEAN SEA SURFACE TEMP (3)	120/576	-----	
0730	ECMWF SURFACE ANAL	120/576	0000	
0800	NORTHERN ICE LIMITS	120/576		
0920	ECMWF SURFACE	120/576	0000	
1000	SURFACE ANAL (SHIPPING)	120/576	0600	
1445	SURFACE ANAL (SHIPPING)	120/576	1200	

NOTES:
1. SEAWARD ANALYSIS FOR PORTION OF AREA ONLY, DEPENDING UPON INFORMATION AVAILABLE.
2. BI-LEVEL CHART. ANALYSIS OVER CONTINENT FOR THE 850MB LEVEL.
3. ON MONDAY, WEDNESDAY AND FRIDAY. (EAST COAST)
4. ON TUESDAY, THURSDAY AND SATURDAY. (WEST COAST)

MAP AREAS: NOT AVAILABLE.

(INFORMATION DATED 12/1990)

NORTHWOOD 1, UNITED KINGDOM

CALL SIGNS	FREQUENCIES	TIMES	EMISSION	POWER
GYA1	2374 kHz	0000-2359	F3C	10 KW
GZZ6	3652 kHz	0000-2359	F3C	10 KW
GZZ2	4307 kHz	0000-2359	F3C	10 KW
GYJ3	6446 kHz	0000-2359	F3C	10 KW
GZZ40	8331.5 kHz	0000-2359	F3C	10 KW
GZZ44	12844.5 kHz	0000-2359	F3C	10 KW
GYA61	16912 kHz	0000-2359	F3C	10 KW

TRANS TIME	CONTENTS OF TRANSMISSION	RPM/IOC	VALID	MAP TIMEAREA
0300	SCHEDULE	120/576		
0315	SURFACE ANAL	120/576	0000	A
0340	SIGNIFICANT SU WIND & WEATHER PROG	120/576	1800	A
0400	SPECIALS AS REQUESTED	120/576		
0500	SPECIALS AS REQUESTED	120/576		
0600	SELECTED RADIOSONDE OBS	120/576	0000	A
0620	NAC TAFS	120/576		
0630	SURFACE ANAL	120/576	0000	A
0655	COMBINED 0°C & 2°C PROG	120/576	1200	A
0705	SIGNIFICANT SU WIND & WEATHER PROG	120/576	1800	A
0800	GALE SUMMARY	120/576		A
0940	SURFACE ANAL	120/576	0600	A
1030	GALE SUMMARY	120/576		A
1300	SIGNIFICANT SU WIND & WEATHER PROG	120/576	0600	A
1330	SEA & SWELL PROG	120/576	0600	A
1335	SEA SURFACE TEMP	120/576		A
1500	SURFACE ANAL	120/576	1200	A
1525	SPECIALS	120/576		A
1550	SPECIALS	120/576		A
1635	SCHEDULE	120/576		
1645	SELECTED RADIOSONDE OBS	120/576	1200	A
1735	GALE SUMMARY	120/576		A
1800	SURFACE ANAL	120/576	1200	A
1825	SIGNIFICANT SU WIND AND WEATHER PROG	120/576	0600	A
1850	SEA & SWELL PROG	120/576	0600	A

MAP AREA: A - 1:10,000,000 77N 084W, 65N 049W, 32N 044W, 28N 001W

(INFORMATION DATED 09/1991)

Cyclones of the Southwest Indian Ocean, 1990–1991

Service Meteorologique
de la Reunion

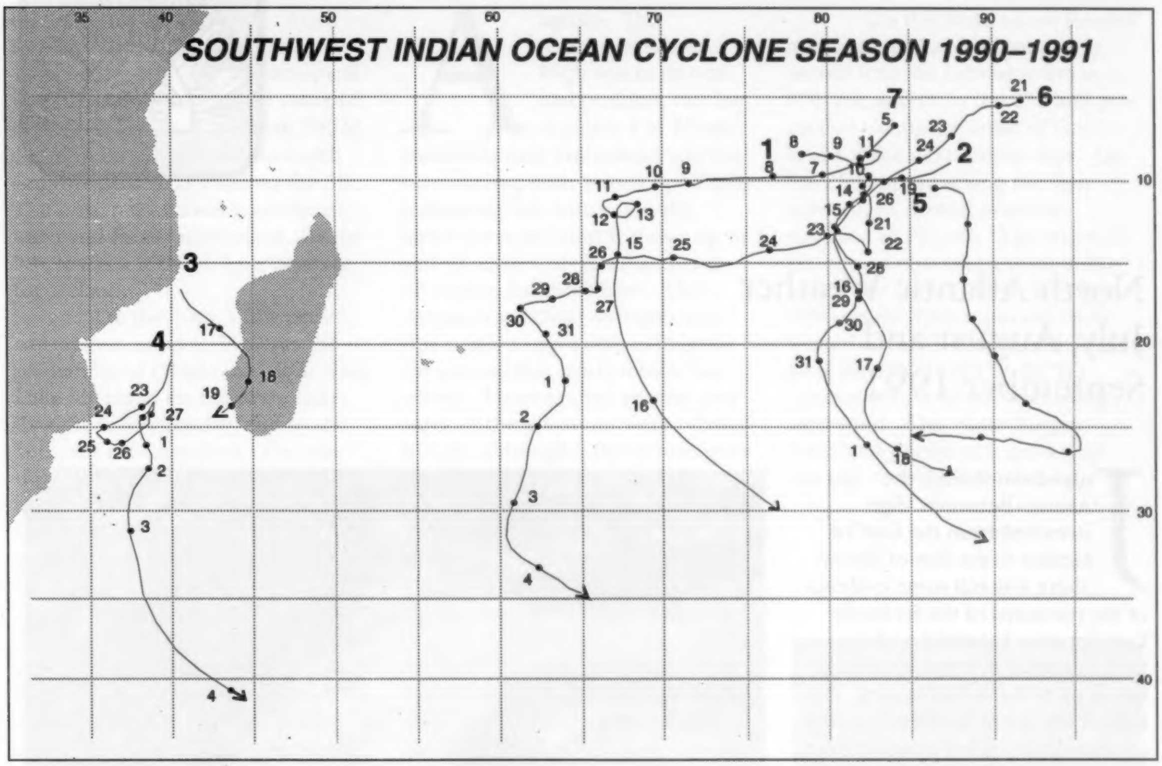
The information used in this brief summary was based on the detailed summary published by the Meteorological Service of Reunion. During the 1990–1991 season, which encompasses spring through fall in the Southern Hemisphere, there were seven named tropical systems in the Southeast Indian Ocean. All occurred in their fall. Another two systems were not named but did reach minimum tropical depression intensity.

Of the seven named storms, three reached tropical cyclone strength (hurricane or typhoon intensity in the Northern Hemisphere). The strongest tropical cyclone of the season was Bella, which had an estimated pressure of 940 millibars with a maximum sustained 10 minute wind speed estimated at 80 knots. This translates into a 1–minute winds speed of about 100 knots and gusts that reach about 125 knots. Bella formed within the Intertropical Convergence Zone on the 18th of January. It reached tropical cyclone strength on the 29th and remained at this intensity into the 31st. During this period it was moving south southeastward between Rodriguez and Mauritius. At Rodriguez the pressure fell to 970 millibars on the 31st at 0300 UTC. Sustained winds reached 78 knots and gusted to 115 knots early on the 31st. In addition rainfall from the 27th through the 31st totaled 5.4 inches. Bella may have been responsible for the loss of the cargo ship ***Gasikara***, which was enroute to Reunion with 36 crewmen onboard. Her last position, which was reported by the shipping company, was 14°S, 65°E at 1400 UTC on the 30th of January. The vessel's estimated arrival date was February 2. On the 5th and 6th the French Navy searched in vain.

Tropical Cyclone Cynthia caused some strong winds on Madagascar, but the intensity of these winds was attributed in large part to local effects. Maintirano (18°S, 44°E) reported a 997–mb pressure with sustained 10–minute winds of 85 knots with gusts to 100 knots. At Besalampy (16.8°S, 44.5°E) sustained winds reached 78 knots with 97–knot gusts. Again the minimum pressure was only 997 millibars.

Terminology used in Southeast Indian Ocean Area

Weak Tropical Depression	less than 33 knots
Moderate Tropical Depression	34–47 knots
Strong Tropical Depression	48–63 knots
Tropical Cyclone	64–90 knots
Intense Tropical Cyclone	91–115 knots
Very Intense Tropical Cyclone	more than 115 knots



Named Tropical Systems in the Southwest Indian Ocean, 1990–1991 Season

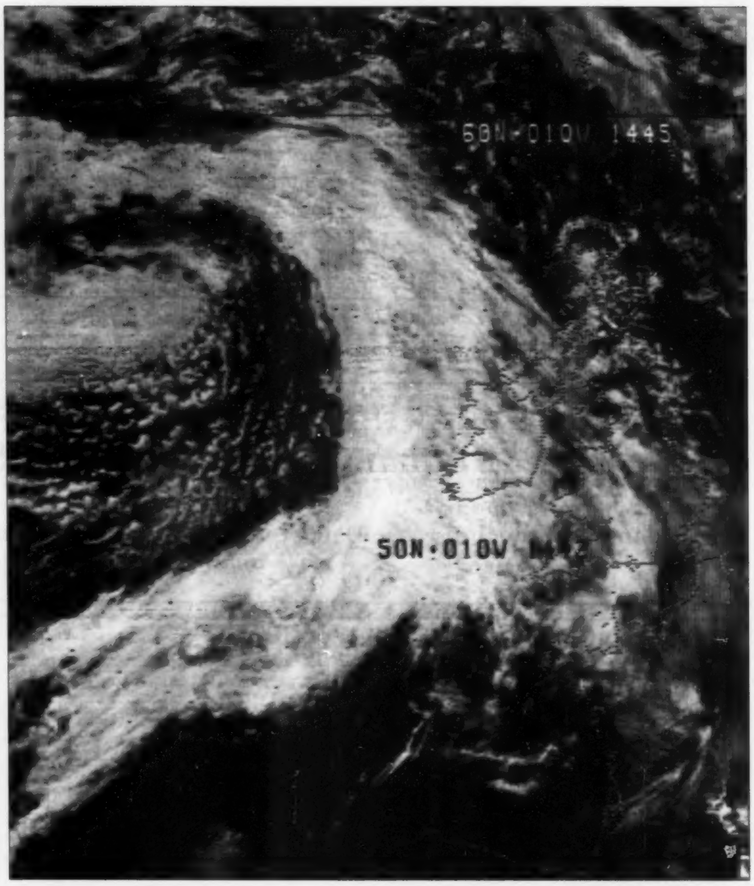
No.	Name	Category	Date	Maximum Wind (kn)	Minimum Pressure (mb)
1	Alison	Td	1/8–1/18 1991	62	966
2	Bella	TC	1/18–2/4 1991	80	940
3	Cynthia	TC	2/16–2/19 1991	85	966
4	Debra	TC	2/22–3/4 1991	65	966
5	Elma	Td	2/26–3/5 1991	55	970
6	Fatima	TC	3/21–4/1 1991	72	954
7	Gritelle	Td	6/5–6/16 1991	44	984

NOTE: In most cases winds and pressures are estimates, based roughly on the Dvorak Technique of determining storm intensity from satellite photographs.

North Atlantic Weather July, August and September 1991

July—Even though the Azores–Bermuda High stretched from the Gulf of Mexico to the Bay of Biscay, there was still some evidence of the remnants of the Icelandic Low between Labrador and Iceland, resulting in negative anomalies of up to 6 mb in this area. A look at the storm tracks shows that an abundance of low pressure centers moved over these waters in July. While most were not intense, a few caused some concern for mariners plying the northern trade routes. The Azores–Bermuda High also bulged over Great Britain and Scandinavia, resulting in positive anomalies for the English Channel, Norwegian Sea and the Baltic.

The month opened with a low pressure area, soon to become Tropical Storm Anna, threatening East Coast shipping. After moving across central Florida, from the Gulf of Mexico, as a tropical depression, this system turned northward and then east northeastward. It became Tropical Storm Anna about 85 mi south of Charleston, SC, on the 3d, after NOAA buoy 41001 reported an 8.5-min wind speed of 33 kn. At 0700 on the 4th, the KJLV (35°N, 76°W) reported a 50-kn westerly, while an unidentified vessel to the



Satellite Data Services Division

A well-defined frontal system is moving into Ireland at about 1440 on the 17th. In this photograph Ireland is in the warm air between the warm and cold fronts of the storm system, with its 990-mb center to the northwest.

east ran into 45-kn winds. Anna lost its tropical characteristics by 1800 on the 5th. The extratropical version, however, retained some of the punch, as the ***Ronneburg*** (38°N, 44°W) was nailed by 52-kn south southwesterlies, at 2100 on the 5th. The system then swung northeastward and finally northward. By the 9th, it was a 990-mb Low heading for Iceland.

On the 10th, a low pressure system came to life over the panhandle of Oklahoma. It buzzed Lake Michigan on the 12th, Lake Erie the following day, and by the 14th was off Cape Cod. The central pressure was about 1006 mb and the storm was nothing to write home about, unless it was spoiling your vacation in one of these locations. On the 15th, it took off toward the northeast and deepened. The following day a 986-mb center was located near 54°N, 32°W (pg 62). At 1200, near 52°N, 28°W the PCNB reported 40-kn southwesterlies and a 994-mb pressure. This pretty well pegged the characteristics of this system. The storm continued on a beeline across northern Scotland on the 18th, with a central pressure that hovered around 990 mb. By the 21st a 998-mb center was observed over the Baltic Sea.

Casualties— Severe thunderstorms with damaging winds battered southern Michigan and northern Ohio on the night of the 7th. The local power company in Detroit, reported that more than 500,000 homes were without electricity. On the 10th at a hospital in Yorkshire, England, a telecommunications and computer system was completely destroyed by a massive bolt of lightning.

August— The Azores-Bermuda High was in its normal position, but the negative 4 to 10 mb anomalies over Greenland and the surrounding seas, were a tipoff that something was amiss. On the mean pressure chart it shows up as sort of an out-of-place and-out-of-season Icelandic Low. The August track chart indicates that this area was alive with extratropical storms, that made it look like winter. However, the central pressures of these systems were relatively high, although a few storms were in the 980-mb range.

This month Hurricane Bob was the dominating feature along the U.S. East Coast (see page 12), although several other Lows kept things interesting over the Atlantic.

A 980-mb Low, near 55°N, 50°W, on the 8th generated gales for a brief time over the northern shipping routes. The VOWN (53°N, 55°W) at 0660 that same day measured a 40-kn wind and several other vessels reported gales. However, once the system turned northeastward, it began to weaken rapidly.

A Low developed over the central U.S. on the 7th, moved south of the Great Lakes and out into the Gulf of St. Lawrence by the 12th. Once over the more friendly confines of the North Atlantic, the system began to deepen. By the 13th, its central pressure had dropped to 992 mb, and the following day, southwest of Iceland, it was down to 985 mb (right). The storm remained near this level as it continued into the Norwegian Sea on the 15th. Ship reports were scattered, but showed winds generally in the 40- to 45-kn range. The GUMF (58°, 3°W) at 0600 on the 16th reported winds of 47 kn, while the ***Charles Darwin***, farther west, ran into 20-ft swells.

On the 20th, a Low formed northwest of Lake Winnipeg. It moved into the Labrador Sea as a 996-mb system by the 23d and proceeded to hug the coast of Greenland for the next several days. On the 25th, approaching the Denmark St, its central pressure dropped to 976 mb. This intensification was noticed by ships in the area. The GDLS (56°N, 30°W) at 0000 on the 25th reported 40-kn westerlies in 20-ft swells, while 6 hr later the OXZJ2 (59°N, 31°W) encountered a 52-kn west southwest wind. This coast-hugger remained potent as it moved up the east coast of Greenland.

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The 985-mb Low is south southeast of Iceland at about 1600 on the 14th.

Casualties– The bulk carrier ***King William*** suffered weather damage in Bob. Also the U.S. Coast Guard rescued a survivor from the fishing vessel ***Nomad***, off New Hampshire, but his companion was dead. In Connecticut, four people died during Bob. This included one death in a traffic accident and one from a falling limb, while a teenage girl and baby boy died in a fire caused by the candles they were using after the electricity went out.

September– This month always has the potential to be hazardous to the health of the merchant mariner and other North Atlantic sailors, with the hurricane season at its peak, and the unofficial beginning of the extratropical season. A cursory glance at the mean September pressure chart is misleading, since the Azores-Bermuda High covers most of the North Atlantic. There is little to reflect the tropical activity, although extratropical activity is somewhat reflected by the tight gradient to the north of the High and the several centers making up the Icelandic Low.

Among the tropical cyclones causing problems this month were Claudette, Danny and Erika. They will be covered in the annual summary, which appears in the Spring issue of the *Mariners Weather Log*.

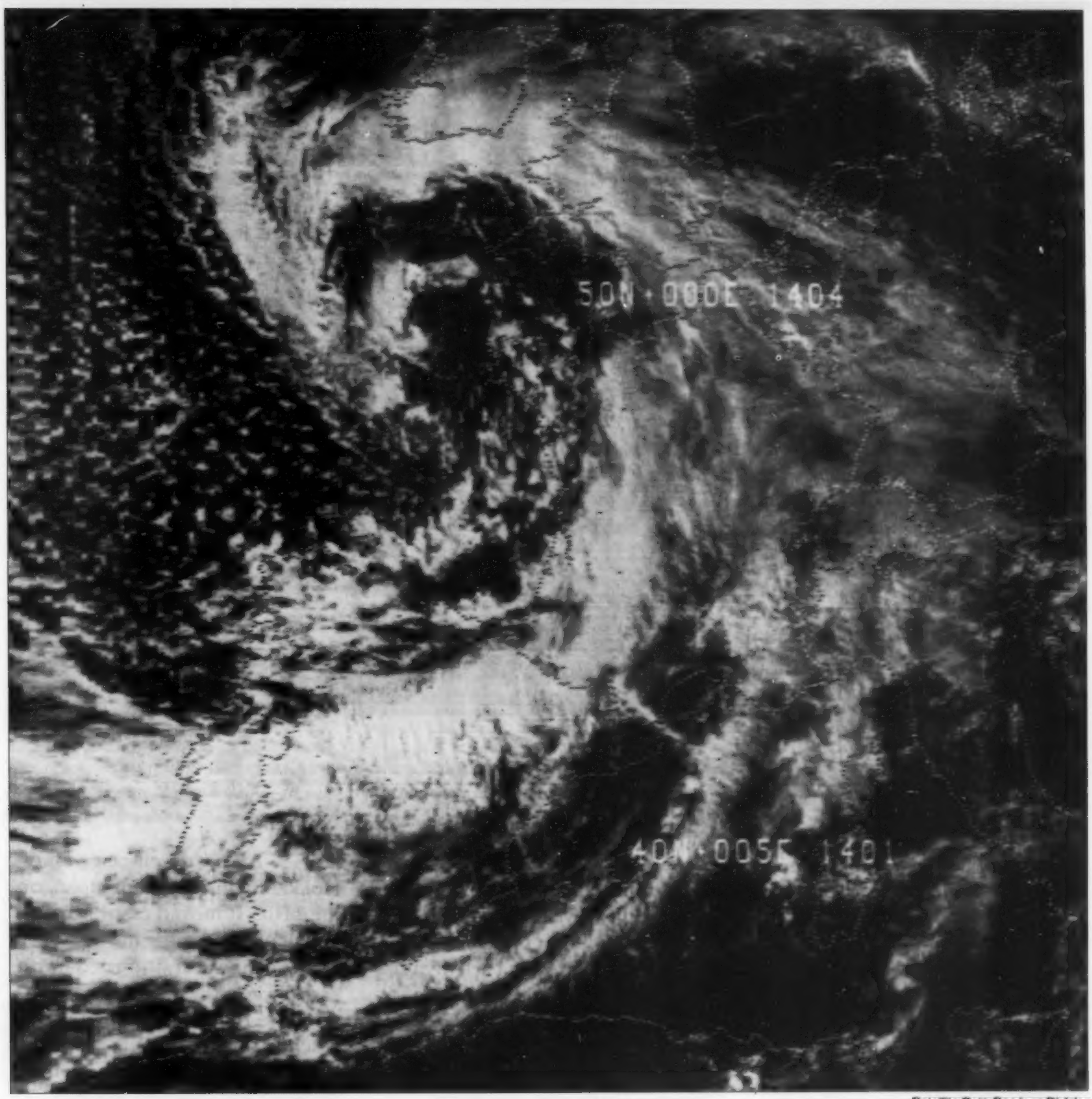
However, the extratropical portion of Danny combined with another extratropical storm on the 17th west of Scotland and bothered shipping and drilling operations for a few days. On the 18th, a 968-mb pressure center was analyzed just east of Iceland. Winds of 40 to 60 kn raked the Denmark St and the Greenland and Norwegian Seas. The GACA (57°N, 23°W) measured 41-kn west southwesterlies in 13-ft seas at 1800 on the 18th. The ***Tasiilaq*** in the Denmark St reported a 58-kn blow. These conditions continued into the 20th. This was not the first big storm of the month, however.

A week prior to the extratropical Danny, on the 11th, a 984-mb storm was spotted near 52°N, 43°W. The following day its pressure fell to 976 mb and 40- to 45-kn winds were encountered in the area. On the 13th, the DBBH ran into 23-ft seas near 54°N, 26°W, while measuring 40-kn southwesterlies. A secondary center to the north prolonged this storm for a few more days, and on the 15th, a 980-mb Low was nearing the coast of Norway.

A couple of Lows brought gale force winds and rough seas to the northern waters of several of the Great Lakes during the last week of the month. On the 22d and 23d a 994-mb Low from South Dakota moved over International Falls, MN and into Ontario Province. During the evening of the 22d, stations and vessels on western Lake Superior were reporting sustained winds of 35 to 45 kn and waves of 6 to 8 ft. As the system continued north of Lake Superior the following day, strong winds and rough seas spread to the northern waters of Lakes Huron and Erie. For example, at 0900 on the 23d Port Colbourne, Ontario (Lake Erie) measured 36-kn winds with gusts to 42 kn, while Stannard Rock, MI (Lake Superior) was still reporting 40-kn winds with gusts to 44 kn. A few hours later the system began to weaken and move out of range. However, a few days later, on the 26th, the same general area was clipped by a southeastward moving Low from the Yukon. Both Lake Superior and northern Lake Huron reported sustained gale force winds. At 0227 on the 26th Trowbridge, Ontario (Lake Superior) observed northwest winds at 48 kn with gusts to 58 kn, while the Phillip R. Clarke (47.3°N, 87.6°W) hit 40-kn winds in 8-ft seas, less than 1 hr later.

Perhaps the most potent storm of the month could be classified as a Hatteras Low, despite the fact that it actually formed inland over North Carolina on the 20th. It looked harmless enough, although the front that triggered it development was attached to a 984-mb storm over Kap Farvel. Even the friendly Gulf Stream did little to boost its performance as it moved northeastward across Newfoundland, sporting a rather modest 1000-mb pressure center on the 21st. By 1200 on the 22d, the pressure fell to 993 mb, and 24 hr later it was down to 966 mb and dropping. At this time it was crossing the 25th meridian near 60°N. From the Denmark St to the Norwegian Sea, ships, drilling rigs and anything else afloat were being blasted by 40- to 50-kn winds in 10- to 15-ft seas. The PGSF (54°N, 4°E) measured 48-kn southwesterlies and a buoy (57°N, 1°E) reported 42-kn winds in 17-ft seas on the 24th, as the 960-mb center headed for Bergen, Norway. There were several storm-force wind reports on the 24th, including a buoy measurement (60°N, 2°E) of 68-kn winds, 17-ft seas and a 975-mb pressure. This was a potent system, which finally moved up the coast of Norway and into the Barents Sea.

The bad weather for the month was not quite over, as a 984-mb center was observed near 54°N, 22°W, heading toward the east southeast. The storm continued to intensify as it brushed Great Britain and slammed into the Bay of Biscay. On the 28th its central pressure plummeted to 968 mb, right over the heart of the shipping lanes. Winds of 40 to 50 kn and 15- to 25-ft seas greeted the



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Blockading the English Channel, this 968-mb Low extended its influence to the Bay of Biscay and even into the Mediterranean Sea by way of a well-defined cold front, which was photographed at about 1400 on the 28th. The center ended up weakening over central Europe in the beginning of October.

mariners who were coming out of the English Channel. The ***Sidelia*** (45°N, 17°W) measured 50-kn winds in 25-ft seas at 1200 on the 28th. ***The Nedlloyd Neerlandia*** (49°N, 10°W) reported a 980-mb pressure at 1200, while battling 26-ft seas and conditions remained fierce throughout the day. The ***Heidelberg Express*** (48°N, 10°W) ran into 33-ft swells and measured 50-kn northerlies at 1800. Storm force winds were common into the 29th, when the storm finally began to weaken as it moved ashore near Brest.

Casualties— None were reported in our usual sources.

All times unless noted are UTC (universal time) and all miles are nautical. For additional detail, tropical cyclones will be covered in the annual reports from the tropical cyclone centers around the world. The weather summaries are based upon the track charts and Northern Hemisphere Surface Charts as well as ship reports, and attempt to highlight the most significant ocean features each month. The track charts are provided by NOAA's National Meteorological Center. If an extratropical storm is particularly bad for shipping, we may designate it as the Monster of the Month. The Gale Tables provided by the National Climatic Data Center at Asheville, NC, have been expanded to include U.S. ships reporting winds of 34 knots or more.

North Pacific Weather July, August and September 1991

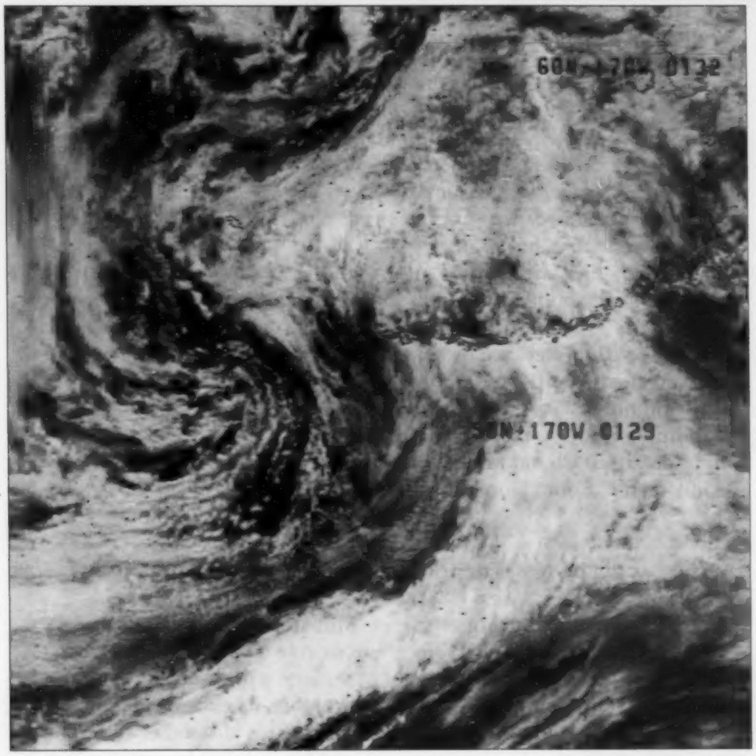
July— The North Pacific subtropical high dominated most of the ocean and even penetrated through the Bering St and into the Arctic Ocean. The remnants of the Aleutian Low were shunted to the Kamchatka Peninsula, where they produced a -4 mb anomaly. The northward extension of the high generated some small positive anomalies in the northern Bering Sea, but otherwise things were normal.

Although the environment in the eastern North Pacific was favorable for tropical cyclone development, only Enrique and Fefa formed during the latter part of the month. Enrique briefly reached minimal hurricane intensity and Fefa eventually strengthened to a 100-kn storm when it moved over the western part of the area.

The track chart for the month indicates two main areas of extratropical cyclone activity— off Kamchatka and in the Gulf of Alaska. The gulf of Alaska activity was comprised of mostly weak to moderate systems.

The month opened with a 980-mb Low near 40°N, 155°E. Moving northward, the storm deepened to 970 mb and then recurved over the southern Kamchatka Peninsula to make the first contribution to this month's Aleutian Low. At 0600 on the 2d, the ***Chita Maru*** sent in a couple of excellent reports near 46°N, 162°E. They measured winds of 41 and 48 kn in 17-ft swells with a pressure of 984 mb. The storm, in the meantime, weakened on the 3d and 4th.

A Low developed west of Hokkaido, in the Sea of Japan, on the 11th. It moved eastward as a 1000-mb system for the next several days. However, it turned northeastward on the 13th and it wasn't until the 15th (right), when it reached the Bering Sea, that it really deepened. By 1200, the central pressure was down to 984 mb. This deepening seemed to go unnoticed by most vessels, although the ***Skaubryn*** (50°N, 165°E) ran into 43-kn west southwesterlies on the 16th as the system moved over Norton Sound. About this time, Typhoon Amy was coming to life east of Luzon as a tropical depression. By the 18th, it was moving into the Taiwan St as a full-fledged typhoon. The ZCAI7



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This system covers a large part of the Aleutian Island chain and the southern Bering Sea on the 15th of July at about 0100. Its cold front stretches to the southwest and the center of the storm is approaching the western Aleutians.

(20°N, 122°E) was rocked by 50-kn winds in 17-ft seas at 0000 on the 18th. Six hours later, swells had increased to 26 ft in the area. The ***Tenaga Lima*** also sent in some valuable observations from the vicinity of the typhoon, which was followed a few days later by Typhoon Brendan. Brendan delivered another blow to northern Luzon on the 22d. Four days later Typhoon Caitlin moved through the Phillipine Sea but did not score a direct hit on battered Luzon. On the 26th, the ***Senshu Maru*** (23°N, 132°E) ran into 58-kn winds in 15-ft swells and the ***Tenaga Lima*** again provided information, when it measured a 45-kn east southeasterly near 25°N, 127°E that same day.

Casualties— Typhoon Amy sent volcanic ash swirling into Manila forcing the closing of Manila Airport for 2 days. The ro-ro ferry ***Emerald I*** capsized in Amy's stormy waters off Batangas Province, just south of Manila. Two people were found dead and two were missing, but 83 passengers and 21 crewmen were rescued. The incident occurred near shore as the ferry was attempting to return to port after developing a bad list. Also in Amy, the tanker ***Blue River*** sank off Taiwan and all 31 crewmen aboard were lost.

August— While the subtropical high prevailed over the North Pacific, as usual, two interesting features appeared on the mean surface pressure charts. A broad low pressure area centered south of Japan reflected the tropical cyclone activity in these waters, and a flurry of extratropical activity in the Gulf of Alaska resulted in negative anomalies in that region.

Hurricane Fefa from July, brought rough weather to the Hawaiian Islands from the 7th to the 9th, while Guillerma and Hilda developed over the eastern North Pacific in August. In the western tropics, Doug, Ellie, Fred and Gladys were the tropical cyclones that roamed those waters during August.

While most of the tropical cyclones remained in the tropics, Doug turned extratropical on the 10th and eventually contributed to the low pressure that prevailed over Baffin Bay on August— yes Baffin Bay. The ex-typhoon arrived over the Alaska Peninsula as a 990-mb Low on the 14th. After turning a 2-day counterclockwise loop, it moved up the Alaskan Peninsula and crossed the Gulf of Alaska. It was tracked across Alaska south of Fairbanks and into the Yukon on the 18th. Paralleling the 60th parallel, the system remained intact and swung across Hudson Bay as a 984-mb Low on the 19th. Baffin Bay was its next destination, and, in fact, it was followed until the 22d when it moved into the Arctic.

On the 6th, a 980-mb center was spotted near 48°N, 172°E. The ***President Adams*** (46°N, 179°W) measured 45-kn winds in 15-ft seas. The following day the storm moved across the Aleutians and into the Bering Sea. Pressure rose to 997 mb by the 8th, as the

storm swung southeastward. Once into the North Pacific again it reintensified, and by the 10th pressure was down to 984 mb just east of Unimak Is. The ***Island Princess*** (59°N, 143°W) at 0600 on the 10th ran into a 40-kn southeasterly there. The following day the system moved northward across the Alaskan Peninsula and into Bristol Bay, where it weakened.

The end of the month saw a flurry of activity as a 984-mb center moved into the central Pacific from the Kuril Is, at about the same time a 992-mb center developed near 45°N, 160°E. Meanwhile, on the 29th a 980-mb Low was observed off the coast of Oregon. It was in the process of reversing its direction and eventually brushed Vancouver Is. At 1800 on the 27th, the ***Prince of Tokyo 2*** (47°N, 168°E) measured 40-kn southerlies in 25-ft swells and these conditions were confirmed by the UPGN, which ran into 43-kn winds nearby. The ***Prince of Tokyo 2*** came in with 46-kn winds the following day, while she was battling swells up to 33 ft. In the storm closer to the coast, the ***Sedco-BP 471*** (48°N, 129°W) measured 41-kn southeasterlies in 15-ft seas at 1200. Three hours later winds rose to 47 kn aboard the vessel. Several other vessels, including the DESW1 and the TTIW1, measured winds in excess of 40 kn on the 29th. The WFDP and the KHJB ran into 40-kn winds late on the 29th and early on the 30th, while the ***Alligator Hope*** (51°N, 132°W) observed 45-kn winds in 23-ft swells at 0600 on the 30th.

Casualties— The worst disaster in the Pacific this month occurred in Typhoon Fred. The derrick barge ***McDermott*** sank in the South China Sea, about 65 mi east of Hong Kong. At the time it was being towed by a tug and trying to carry evacuated workers from nearby platforms out of the typhoon danger area. A full-scale air-sea rescue operation was launched from Hong Kong, involving two Royal Navy patrol craft and three merchant vessels. Some seven aircraft, including four RAF helicopters dropped dinghies and liferafts into the area. Helicopter pilots said it was the worst weather they had ever been out in. Because of heroic rescue effort 173 people were saved and only 22 lost their lives. In addition Fred was responsible for 14 deaths in China, while 72 people died in South Korea during Gladys.

September— Before reading further, take a look at the Pacific portion of the mean pressure chart for this month. Go ahead, we'll wait. Now, you won't see an Aleutian Low like that even in January. What happened? Three wolves in sheep's clothing caused this pressure abberation. Ex typhoons Ivy, Luke and Mireille were posing as extratropical systems when they exploded on the weather scene in northern waters.

These two typhoons were part of six tropical cyclones that formed in the tropical western Pacific in September. Four of these attained typhoon intensity— Ivy, Kinna, Nat and Mireille. Three tropical cyclones formed in eastern waters and two of those reached hurricane strength.

Ivy began as a tropical depression over the Caroline Is on the 2d. It attained typhoon strength on the 5th about 200 mi east northeast of Guam on the 5th. Ivy swept across the northern Marianas on the 6th and recurved on the 8th, accelerating northeastward in the process. It evolved into an extratropical storm by the 10th with a 976-mb central pressure. This fell to 972 mb the next day and to 960 mb by the 12th near 47°N, 173°W (right). More than a dozen vessels reported winds in excess of 40 kn and wave height reached 17 ft. At 0600 on the 13th the D7BE (55°N, 172°W) measured 50-kn north northwesterlies. By the 13th, however, the storm was turning northward and beginning to fill.

Monster of the Month— Under our rule a tropical cyclone can't become a monster, but nothing prohibits its extratropical stage, which is an altogether different animal from doing so. In this case it is more than justified— a 944-mb Low in September, with Luke as the culprit. Luke formed on the 15th, around the same time as Mireille and Nat. Typhoon Luke recurved past Tokyo on the 19th, while Mireille had become a typhoon in the Marianas. The following day Luke completed its extratropical transformation and its 980-mb center was cruising the 45th parallel. Then it turned east northeastward and the bottom fell out. At 0000 on the 21st a 978-mb pressure fell to 960 mb by 1200. The storm's circulation stretched from Kamchatka to the Gulf of Alaska and south to the 35th parallel. On the 22d, the DVDM (54°N, 156°W) reported a 955-mb pressure and the Sea-Land Voyager, a short distance away, measured 960 mb in 33-ft swells with a 45-kn northeasterly. This was 6 hr after the central pressure in the storm

Satellite Data Services Division

This beautiful satellite photograph shows the tight circulation around ex typhoon Ivy, and, except for the lack of an eye, is reminiscent of a tropical cyclone circulation. The Aleutians are just to the north and this was shot taken on the 12th of September at about 0200. A short time later the central pressure was estimated near 960 mb.

was estimated at 944 mb (below). The NOAA ship ***Miller Freeman*** (57°N, 173°W) encountered a 50-kn northeasterly at 2100 on the 22d. By this time the storm had begun to slow over the Alaskan Peninsula. It remained in Bristol Bay through the 23d. The JAPQ (54°N, 152°W) measured 49-kn southerlies in 43-ft swells at 0000 on the 23d, and this was confirmed by the Miller Freeman to the west, which was battling 41-ft swells. These horrendous conditions continued throughout the day, but fortunately the storm was weakening fast.

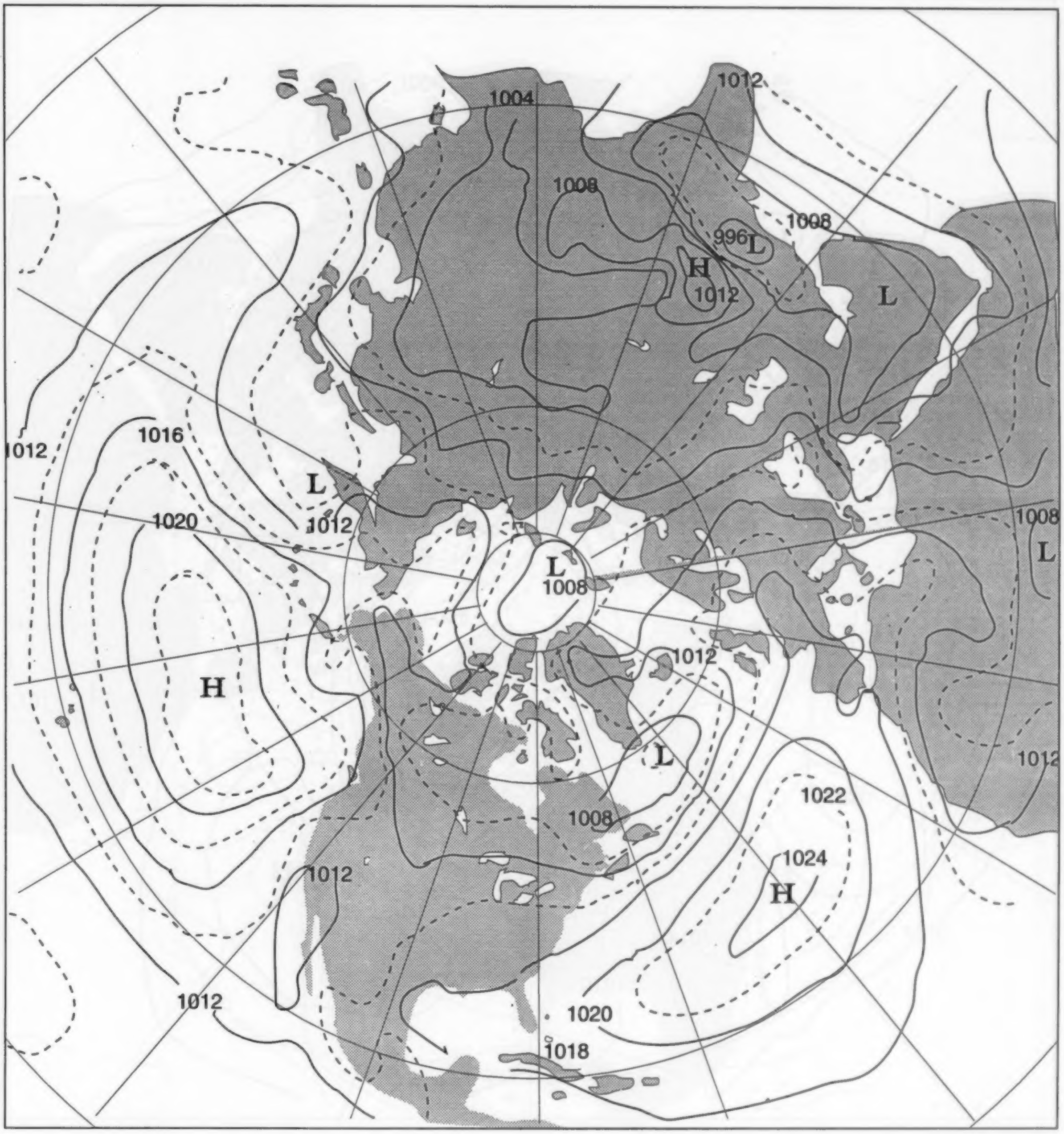
By this time Mireille was beginning to recurve east of Taiwan. It smashed through Kyushu and Honshu on the 27th and lost its tropical characteristics, but not its intensity, as it moved across Hokkaido the following day. As a 965-mb Low the extratropical storm barreled through the Kurils and into the Bering Sea. By 1200 on the 29th, a 954-mb center was observed over the Pribilof Is. Several vessels encountered 50-kn winds on the 29th and the ***Merchant Pride*** (53°N, 173°E) measured a 60-kn southeasterly at 0600. Swells of 25 to 30 ft were also being encountered and the pounding continued into the 30th.

Casualties— In Ivy one person was killed and four other missing when two fishing boats capsized off the southern coast of Kyushu. During Kinna in the Ryukyus one fisherman was killed and two others reported missing after their boat capsized. The ***Isadore Hecht*** due Yokohama reported hatch damage in Luke. In Tokyo seven construction workers were trapped overnight in a mud-filled tunnel after Luke's passage. They were considered part of the total number of 14 who lost their lives in this typhoon. Mireille was responsible for 51 deaths in Japan along with damage to 32 vessels. The ***Jinyung No. 7*** capsized while at anchor in Hakata, with four people missing and 10 rescued. South Korea reported that two people died and two were missing due to this typhoon. Joel was responsible for five deaths in China.

Satellite Data Services Division

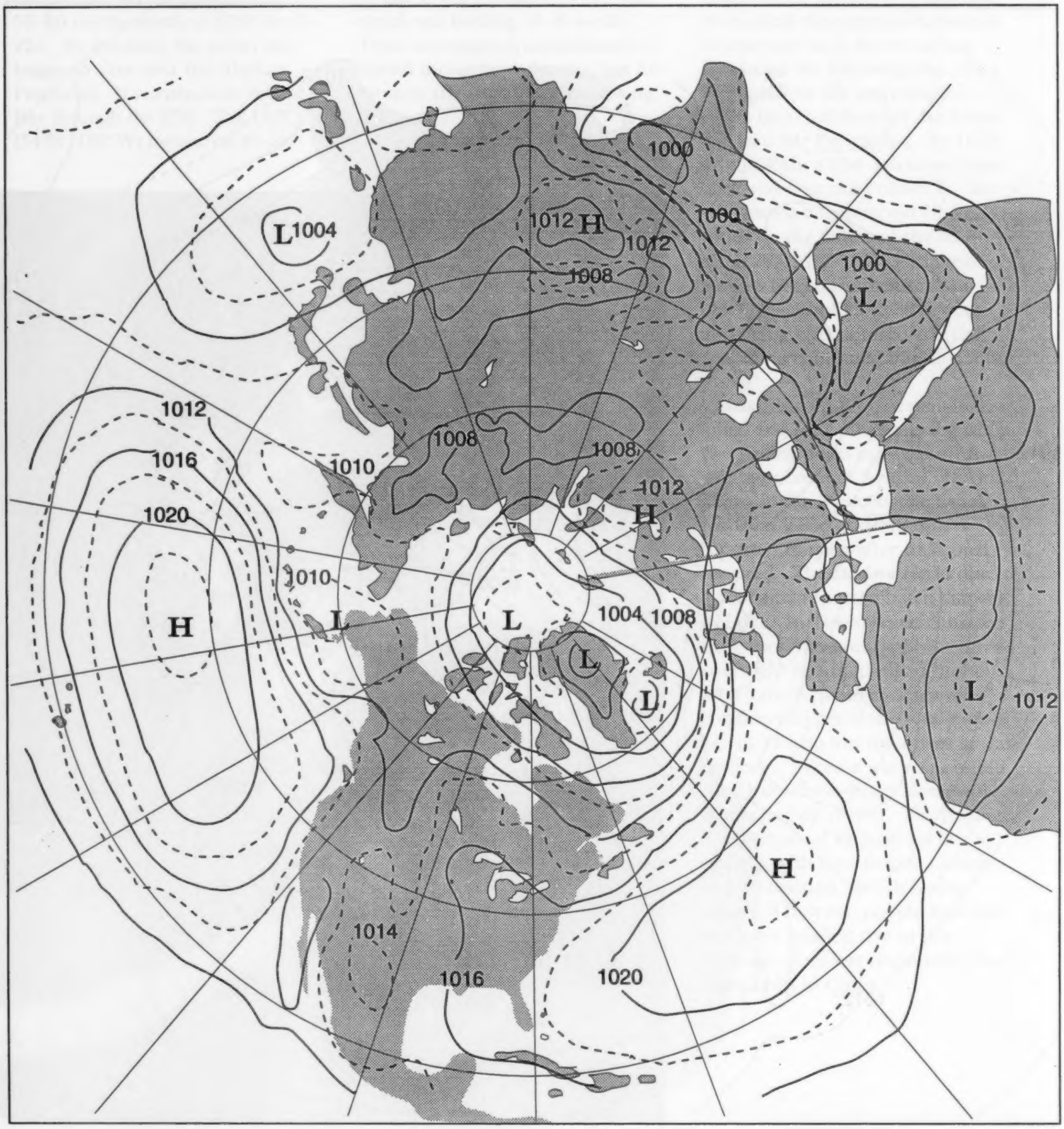
Another photogenic storm was ex tropical storm Luke– the Monster of the Month. Shown here at about 0130 on the 22d, it was near peak intensity at 944 mb.

July 1991



These Charts were Provided by John Kopman and Vernon Kousky of the Climate Analysis Center from the *Climate Diagnostics Bulletin.*

August 1991



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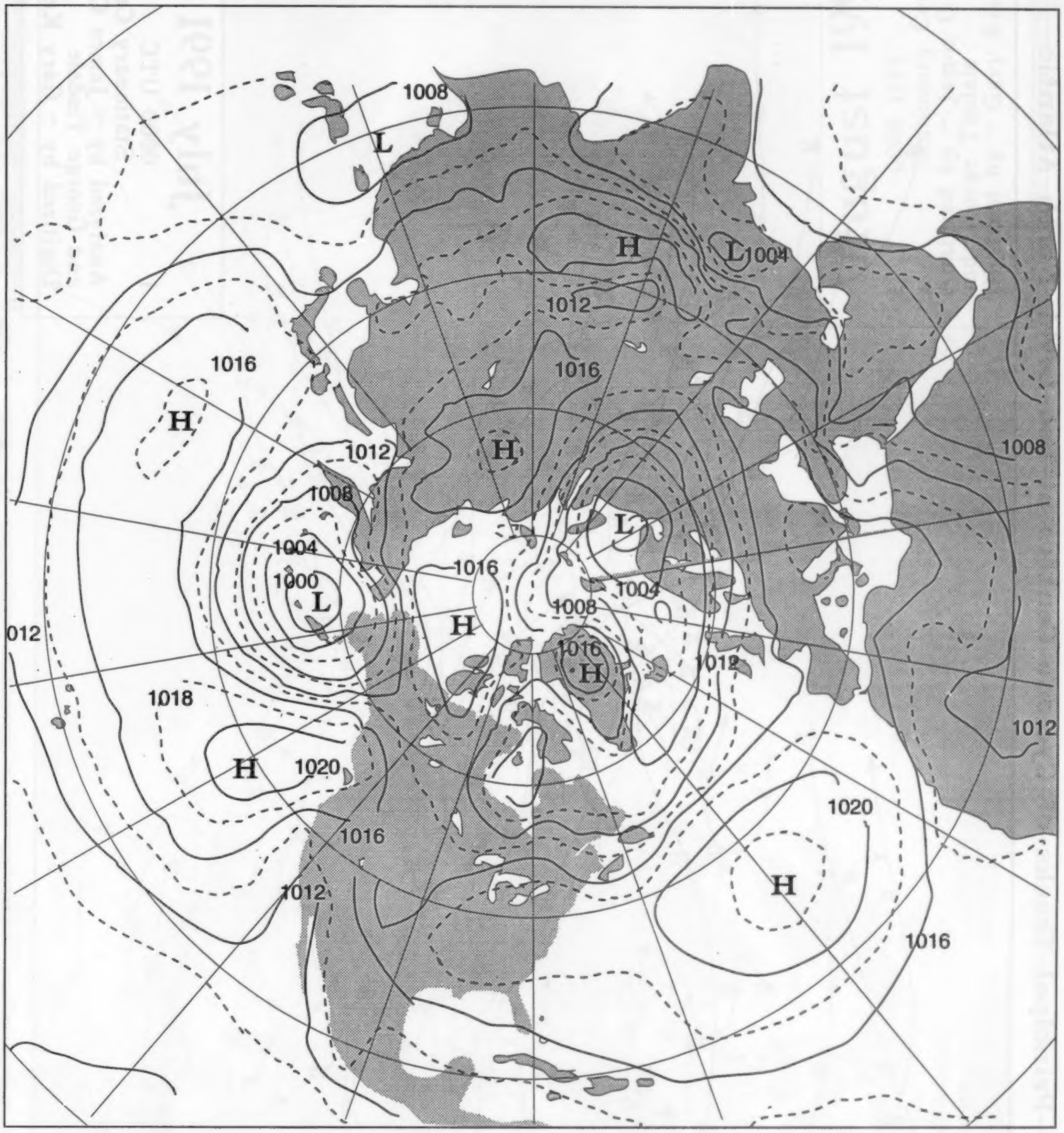
September 1991



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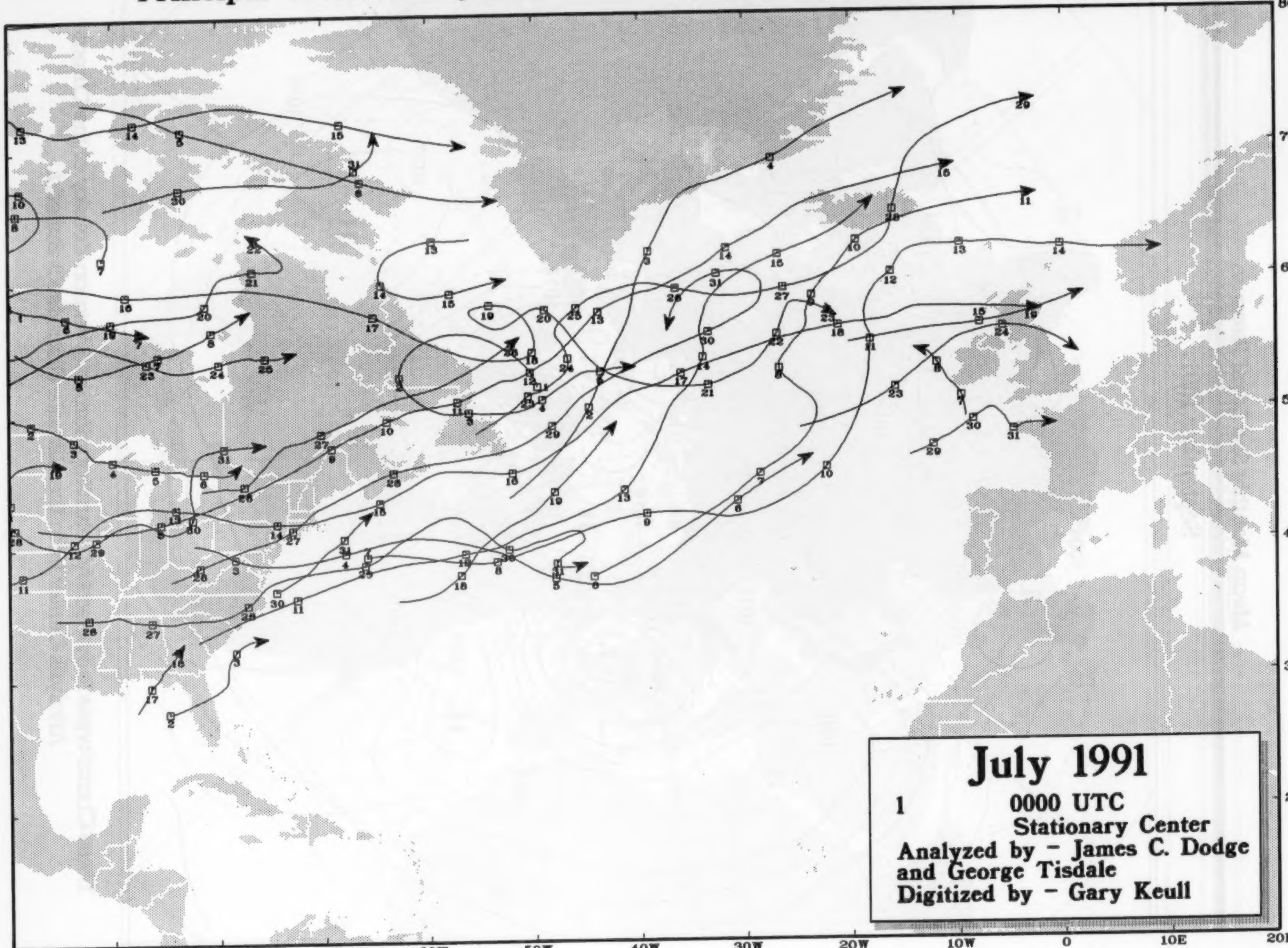
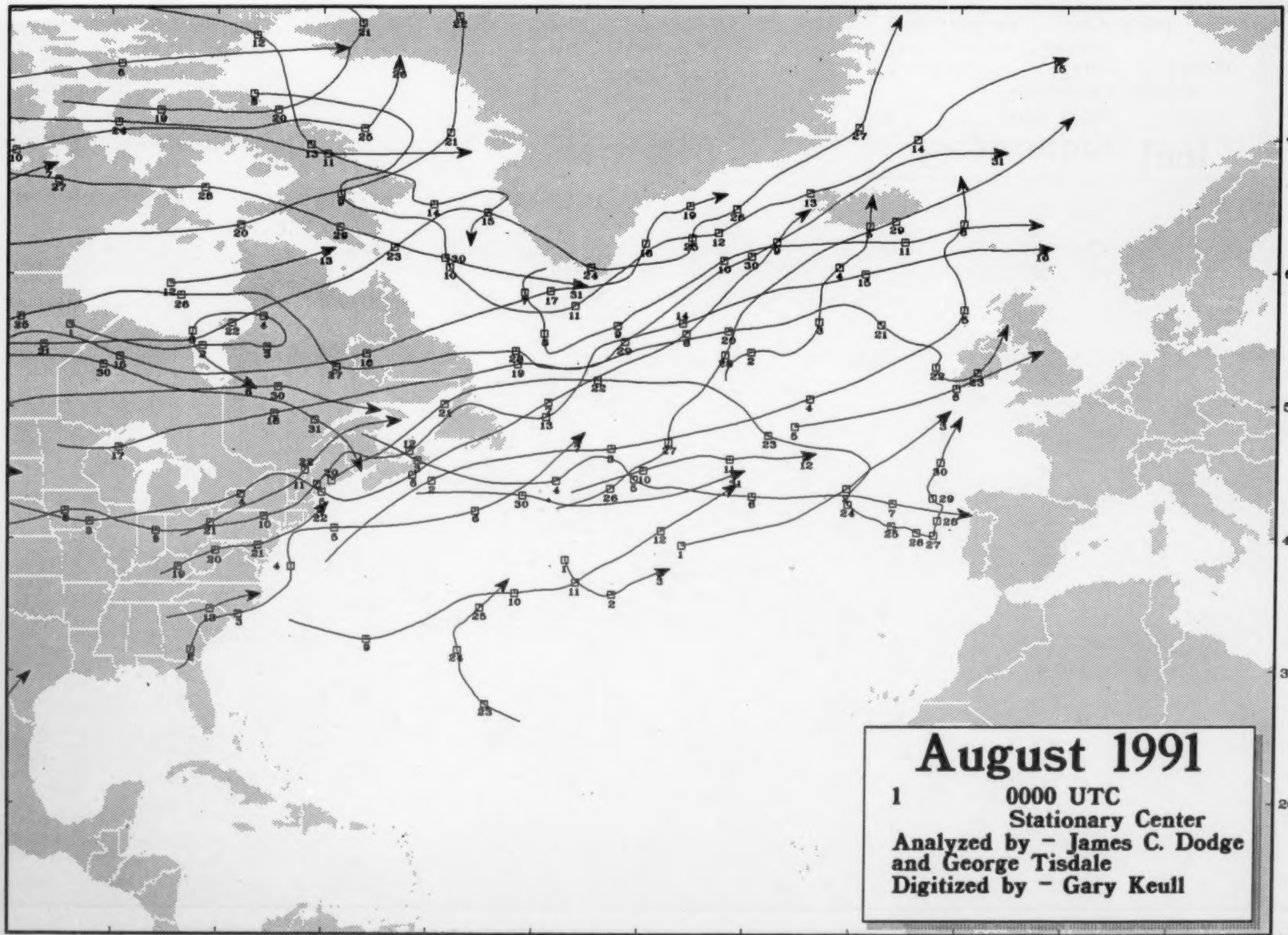
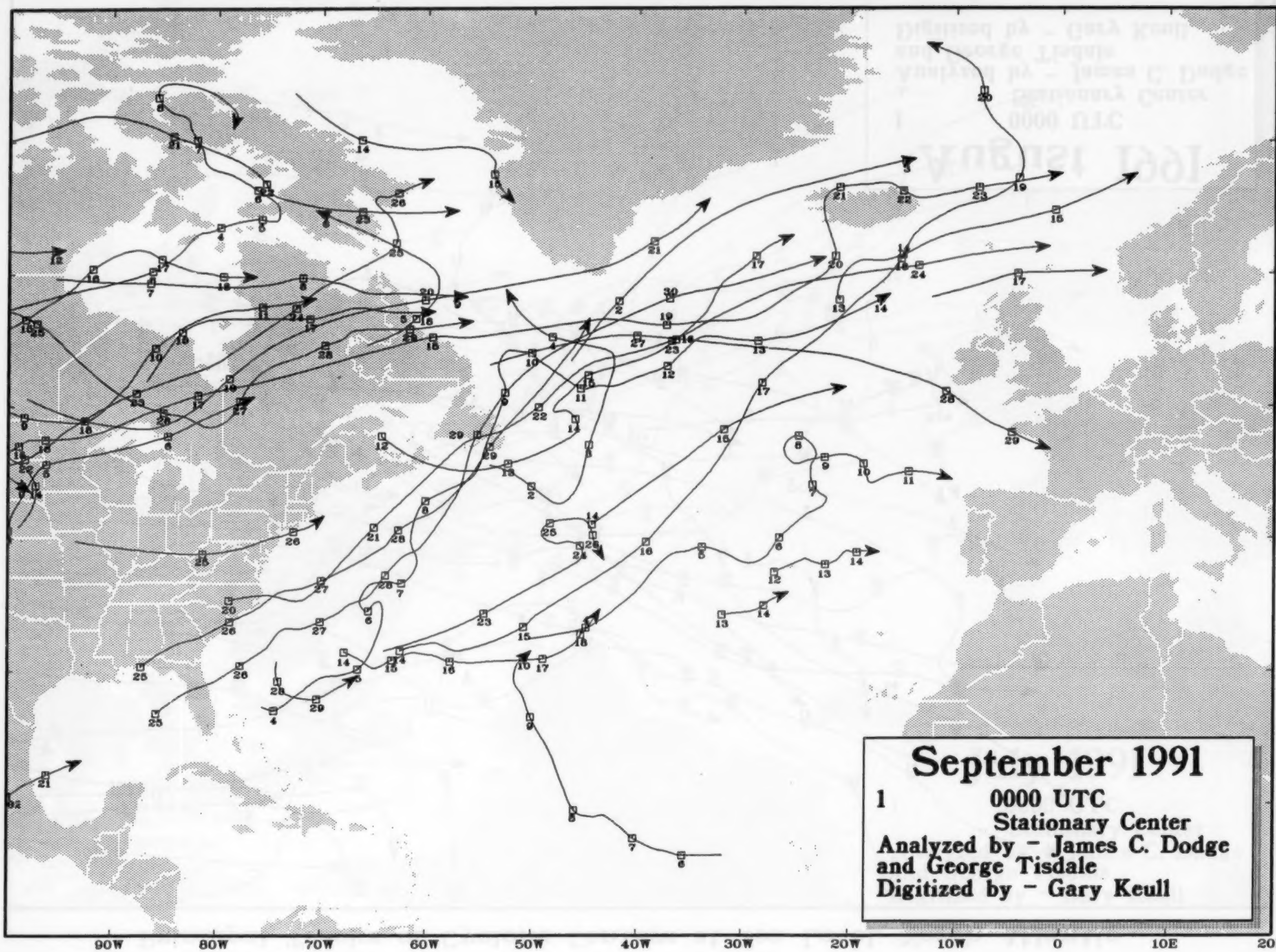
Principal Tracks of Cyclone Centers at Sea Level, North Atlantic



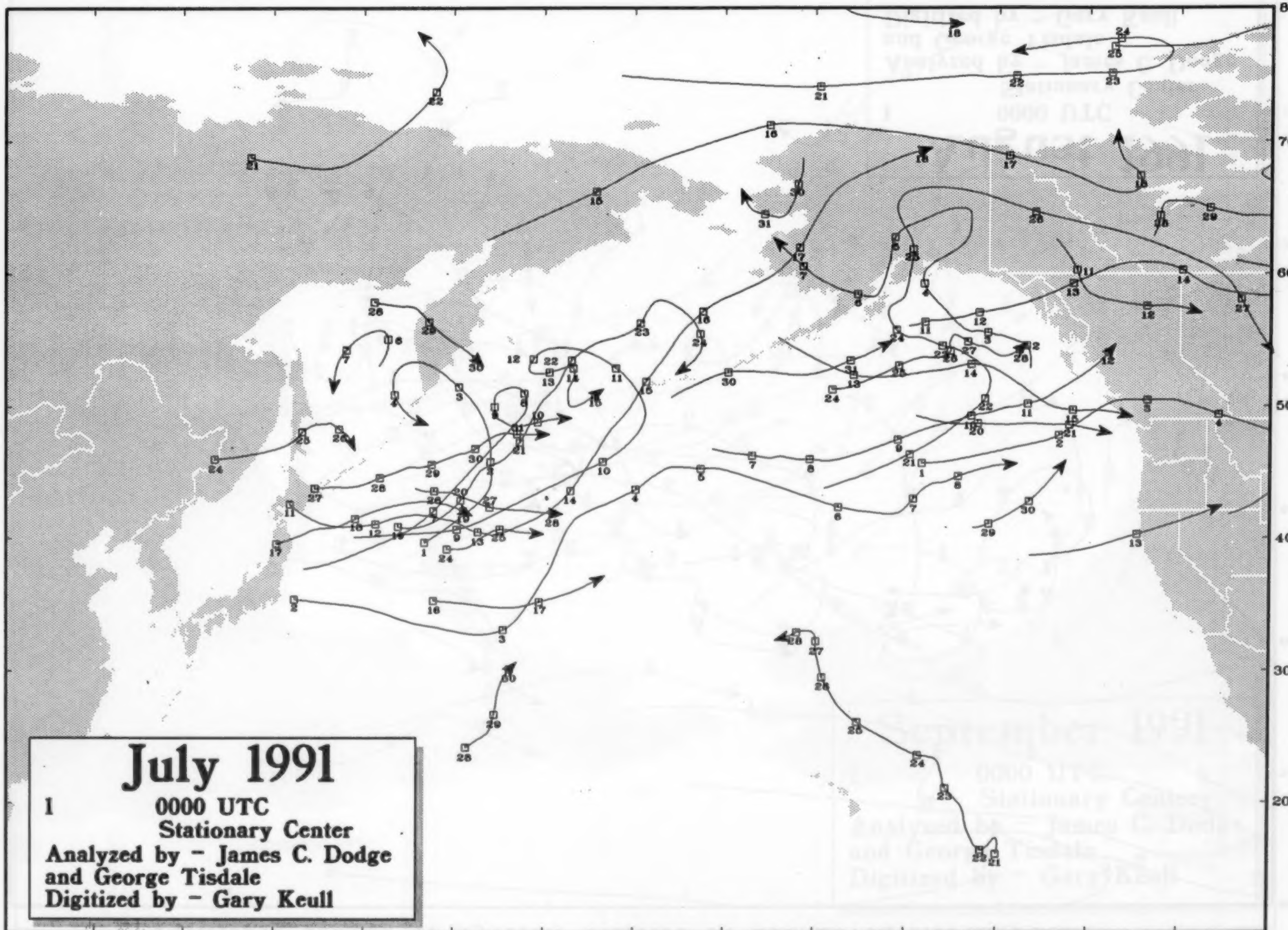
Principal Tracks of Cyclone Centers at Sea Level, North Atlantic



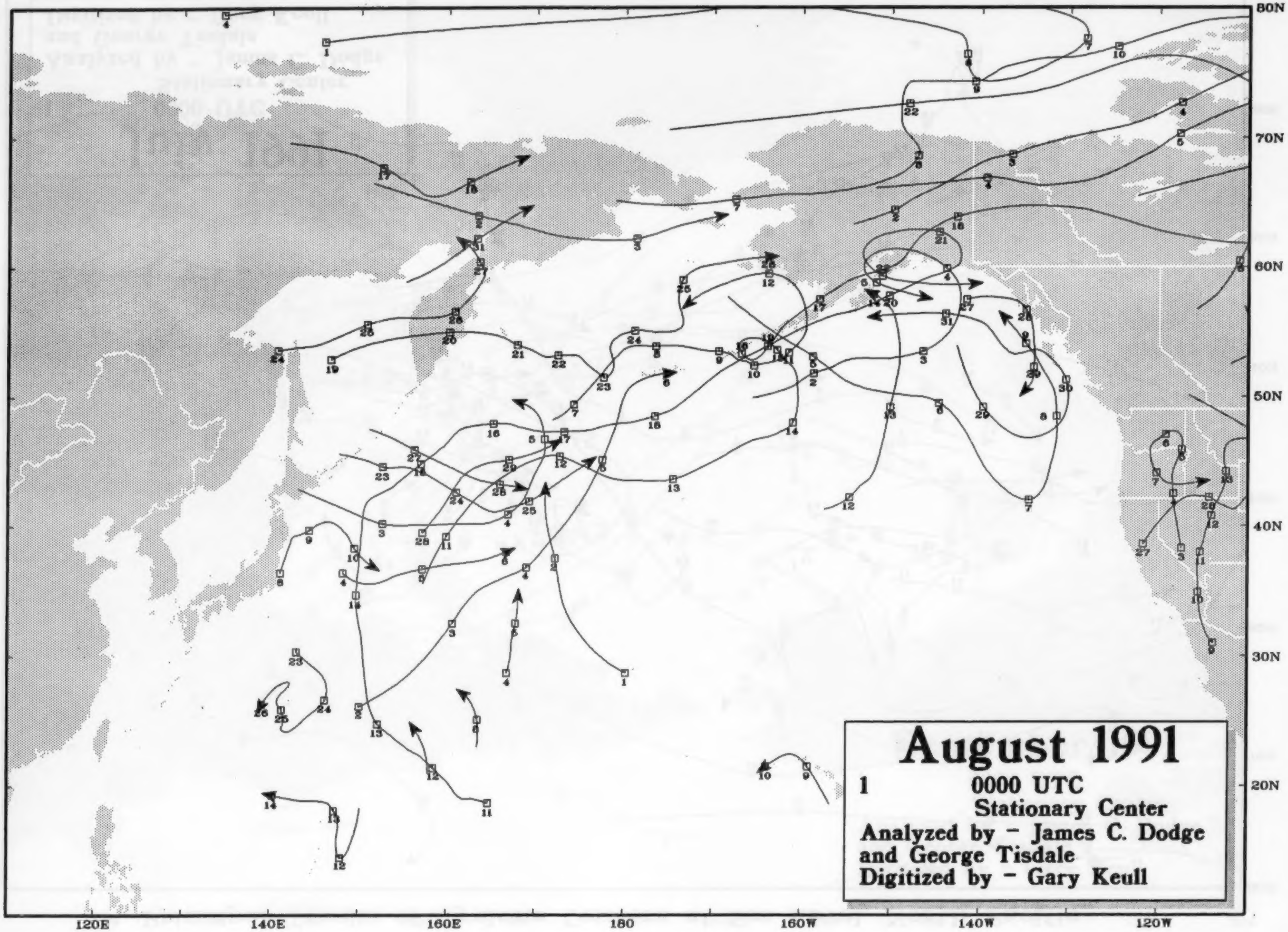
Principal Tracks of Cyclone Centers at Sea Level, North Atlantic



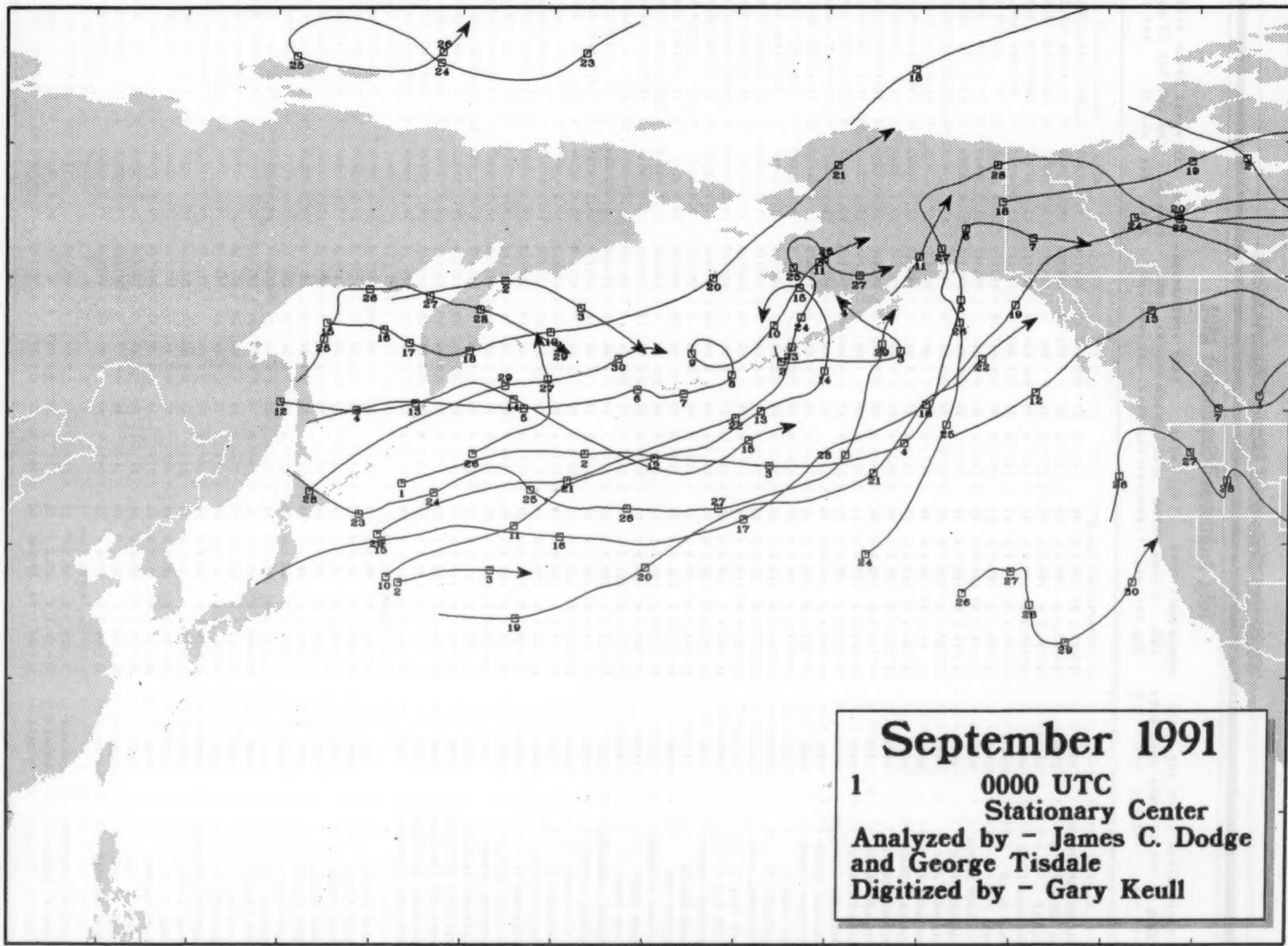
Principal Tracks of Cyclone Centers at Sea Level, North Pacific



Principal Tracks of Cyclone Centers at Sea Level, North Pacific



Principal Tracks of Cyclone Centers at Sea Level, North Pacific



Selected Gale and Wave Observations

July, August and September 1991

VESSEL	SHIP CALL	DATE	POSITION LAT. deg.	LONG. deg.	TIME GMT	WIND DIR. 10 deg.		SPEED kts.	VSBY	PRES WX. code	PRESS-URE mb	TEMP °C. Air	SEA Sea	WAVES PD sec	WAVES HGT ft.	SWELL DIR	WAVES PD sec	WAVES HGT. ft.
			PACIFIC JULY															
SEALAND ENTERPRISE	KRGB	1	48.3 N	174.8 E	18	13	M	37	200 YD	47	1007.6	8.9	5.6	9	13	14	9	13
SEA BELLS	ELCN7	2	47.0 N	163.5 E	00	18	M	35	1 NM	40	0980.0	10.0	7.0	8	11.5	18	8	11.5
SALINAS	3EPF3	2	46.0 N	159.2 E	12	26	M	40	2 NM		0992.0	6.0	7.0	10	16.5	20	12	19.5
PRESIDENT ADAMS	WRYW	2	45.0 N	176.3 E	12	16	M	35	200 YD		1004.5	12.0	10.3	4	6.5	14	6	10
ANGLO ORION	ELLR6	3	39.3 N	124.3 W	06	34	M	37	10 NM		1014.5	15.0	13.0	7	8	34	6	6.5
DIANA	V7CF	4	36.7 N	142.2 E	23	22	M	35	.5 NM	24	0998.0	23.5	25.0	6	8	22	7	10
MC-KINNEY MAERSK	OUZW2	5	38.5 N	125.8 W	12	35	M	47	5 NM		1016.0	13.2	14.0	6	16.5	34	8	23
PRESIDENT POLK	WRYD	5	38.9 N	125.7 W	12	34		35	10 NM		1009.6	12.5	11.8	5	14.5	36	9	13
PRESIDENT POLK	WRYD	6	40.7 N	129.9 W	00	01		36	10 NM		1022.2	13.5	14.9	6	16.5	36	11	18
SANSINENA II	WSIN	6	44.1 N	126.6 W	06	01	M	36	5 NM		1018.0	13.9	8.3	8	16.5			
KEYSTONE CANYON	KSFK	6	40.5 N	125.5 W	12	35	M	40	5 NM		1011.5	12.8	12.2	8	18	35	12	21
KEYSTONE CANYON	KSFK	6	40.7 N	125.6 W	18	35	M	40	5 NM		1014.2	13.3	12.2	8	16.5	35	12	21
KEYSTONE CANYON	KSFK	7	41.3 N	125.7 W	00	35	M	40	5 NM		1014.0	13.4	12.2	8	16.5	35	12	19.5
KEYSTONE CANYON	KSFK	7	42.9 N	126.3 W	12	35	M	37	5 NM		1017.5	12.2	11.1	10	11.5	35	15	13
PRESIDENT JEFFERSON	WPGE	7	34.0 N	129.4 E	12	24	M	40	5 NM	01	1001.2	23.3	22.2	3	10	24	7	16.5
DELAWARE TRADER	WXWL	7	41.4 N	125.8 W	12	35		35	5 NM		1014.8	14.0		4	8	02	6	11.5
KEYSTONE CANYON	KSFK	7	43.6 N	126.6 W	18	35	M	37	5 NM		1020.0	15.0	15.0	10	11.5	35	15	13
SEA LIGHT	ELDE9	8	48.3 N	159.0 E	00	05	M	35	10 NM		1012.1	8.0	1.0	3	6.5	32	5	8
SEA LIGHT	ELDE9	9	45.7 N	152.4 E	06	36	M	36	10 NM		1013.0	1.0	1.0	3	3	36	3	6.5
CONTIENTAL WING	ELJS6	9	37.9 N	155.6 E	12	04	M	35	10 NM		1001.5	19.0	18.0	7	13	04	7	13
OOCL FAIR	ELFV2	12	42.9 N	160.4 E	18	07	M	35	2 NM	60	1008.0	10.0		9	10	05	9	10
OLIVE ACE	ELKD7	14	40.8 N	168.4 E	00	34	M	37	2 NM		1007.0	13.0	18.0	9	10	35	13	8
KEYSTONE CANYON	KSFK	14	50.2 N	130.9 W	12	15	M	36	2 NM	81	1009.0	13.3	13.9'	8	10	27	18	13
HOEGH MASCOT	C6IM4	17	52.6 N	163.6 W	12	25	M	35	2 NM		1018.0	9.0		5	10	25	9	16.5
LIBERTY SUN	WCOB	19	35.7 N	152.3 E	00	26	M	40	< 50 YD	82	1005.5	24.0		2	19.5	26	2	16.5
SEALAND EXPLORER	·WGJF	19	38.9 N	163.3 E	18	19	M	38	200 YD		1005.4	21.0	17.8	4	13	23	5	13
GREEN SUMA	3EVE5	22	50.3 N	139.9 W	06	21	M	44	200 YD	42	1000.2	13.0	13.0	10	16.5	21	12	19.5
GREEN SUMA	3EVE5	22	50.1 N	137.9 W	12	22	M	36	200 YD	42	1013.0	11.0	13.0	10	16.5	21	12	19.5
SEALAND ANCHORAGE	KGTX	22	53.1 N	154.5 W	12	34		40	5 NM	03	0996.0	10.0	9.4	6	8	04	8	13
SEALAND SPIRIT	WFLG	22	43.1 N	139.1 W	12	21	M	38	10 NM	18	1011.5	16.1	15.6	3	5	20	6	11.5
B.T. ALASKA	WFQE	22	42.8 N	125.8 W	12	36	M	35	10 NM		1018.0	15.6	15.6	4	10	36	4	13
SANSINENA II	WSIN	22	57.6 N	143.2 W	12	05	M	38	2 NM	63	1005.9	12.2	11.7	5	13			
SEALAND SPIRIT	WFLG	22	42.4 N	136.4 W	18	17	M	38	10 NM	07	1013.5	17.8	16.1	4	5	18	9	11.5
SANSINENA II	WSIN	22	58.2 N	146.7 W	18	05	M	35	2 NM	16	1006.0	13.3	11.7	5	13	24	8	16.5
KEYSTONE CANYON	KSFK	23	58.3 N	143.2 W	00	10	M	42	5 NM	50	1011.0	12.2	13.9	6	13	12	10	18
KEYSTONE CANYON	KSFK	23	57.7 N	142.3 W	06	12	M	36	2 NM	50	1014.2	11.7	11.7	6	14.5	13	10	19.5
PRESIDENT TRUMAN	WNDP	26	40.2 N	126.2 W	18	02	M	35	10 NM		1014.0	12.0	13.7	10	11.5	33	10	13
PRESIDENT JEFFERSON	WPGE	28	30.2 N	133.2 E	12	16	M	35	10 NM	03	1004.8	29.4	29.4	4	8	24	12	16.5
PRESIDENT JEFFERSON	WPGE	28	29.4 N	134.0 E	18	18	M	38	10 NM	02	1005.5	28.9	29.4	4	8	24	12	16.5
PRESIDENT JEFFERSON	WPGE	29	29.7 N	133.5 E	00	19	M	35	10 NM	01	1006.3	28.3	25.6	3	6.5	22	10	16.5
PRESIDENT JEFFERSON	WPGE	29	31.0 N	131.6 E	06	20	M	35	5 NM	02	1001.1	30.0	25.6	3	6.5	22	10	16.5
			ATLANTIC JULY															
GREEN RIDGE	WRYL	2	37.3 N	09.3 W	12	33		42	5 NM	02	1019.0	19.0	20.0	3	6.5	33	5	11.5
GREEN RIDGE	WRYL	2	38.5 N	09.6 W	18	34		42	5 NM	02	1018.5	17.2	20.0	5	6.5	34	6	13
GREEN RIDGE	WRYL	3	39.6 N	09.7' W	00	33		42	5 NM	02	1018.0	17.0	20.0	5	8	33	5	14.5
GREEN RIDGE	WRYL	3	40.6 N	09.6 W	06	36		48	5 NM	02	1017.0	15.5	20.0	4	6.5	35	7	13
GREEN RIDGE	WRYL	3	42.2 N	09.7 W	12	36		35	10 NM	02	1017.0	18.0	20.0	4	5	36	5	10
EVER VITAL	BMCL	6	41.2 N	25.4 W	12	22	M	35	5 NM	02	1017.5	24.0		4	8	22	9	11.5
ARGONAUT	KFDV	6	40.9 N	35.3 W	12	36		40	5 NM	01	1004.0	20.6	22.2	7	19.5	18	6	14.5
EVER VITAL	BMCL	6	40.1 N	27.1 W	18	19	M	38	5 NM	02	1017.0	25.0		5	8	22	6	10
EDYTH L.	C6YC	6	13.2 N	81.7 W	18	07	M	38	5 NM	25	1013.0	31.0	27.0	6	8	05	7	8
ARGONAUT	KFDV	8	41.0 N	49.0 W	00	13		35	2 NM	63	1011.0	20.0	23.3	10	13			
NEDLLOYD HOLLAND	KRHX	11	47.9 N	13.8 W	12	22	M	55	10 NM		1015.0	22.8	14.4	6	6.5			
GREEN RIDGE	WRYL	13	40.5 N	09.9 W	00	35		37	10 NM	01	1024.0	18.0	15.0	3	6.5	35	4	11.5
UCHOA	ELBU9	13	37.5 N	14.8 W	12	03		40	10 NM		1022.0'	20.5	20.0	5	13	04	6	19:5
CAPE JOHNSON	WJHA	16	38.6 N	51.5 W	06	25		35	5 NM	05	1017.4	22.8	21.1	4	18			
ROBERT E. LEE	KCRD	23	36.4 N	47.6 W	12	23		35	10 NM		1016.5	26.7	23.9	3	8	26	5	10
UCHOA	ELBU9	26	38.1 N	14.2 W	00	06		40	10 NM		1024.0	19.0	20.0	5	10	06	6	13
USCGC FORWARD	NICB	31	10.0 N	77.4 W	12	04	M	44	5 NM	96	1013.3	25.0	28.3			04	4	10
			GR. LAKES AUG.															
EDWARD L. RYERSON	WM5464	8	43.0 N	86.9 W	17	07	M	38	5 NM		1015.9		17.0	XX	6.5			
EDGAR B. SPEER	WQZ9670	20	42.4 N	87.2 W	00	01	M	38	10 NM			20.0	20.0	4	10			
EDWARD L. RYERSON	WM5464	31	47.6 N	88.2 W	18	35	M	37	10 NM		1027.0	- 1.0	- 1.5	XX	6.5			

July, August and September 1991

VESSEL	SHIP CALL	DATE	POSITION LAT. deg.	LONG. deg.	TIME GMT	WIND DIR. 10 deg.		SPEED kts.	VSBY	PRES WX. code	PRESSURE mb	TEMP °C. Air	SEA Sea	WAVES PD sec	HGT ft.	SWELL DIR	WAVES PD sec	HGT. ft.
			PACIFIC		AUG.													
PRINCE WILLIAM SOUND	WSDX	1	59.7 N	145.3 W	00	13		36	.5 NM		1005.0	11.1	11.7	6	10	13	8	11.5
PRINCE WILLIAM SOUND	WSDX	1	58.1 N	143.1 W	12	14		35	1 NM	80	1006.0	11.1	11.7	4	8	14	7	11.5
PRESIDENT GRANT	WEZD	1	50.1 N	135.5 W	18	20	M	35	5 NM		1014.7	13.9	12.2	4	11.5	24	9	10
MACKINAC BRIDGE	JKES	3	39.8 N	126.4 W	18	35	M	35	5 NM		1016.4	17.0	13.0	4	6.5	33	8	11.5
CHEVRON CALIFORNIA	WCGN	3	55.6 N	148.4 W	18	33	M	35	5 NM	20	0995.2	12.2	10.0	5	10	33	8	6.5
MC-KINNEY MAERSK	OUZW2	5	37.1 N	172.0 E	18	17	M	40	2 NM		1012.0	24.2	24.4	5	16.5	18	6	19.5
NANCY LYKES	WCUU	6	44.1 N	139.0 W	06	33		35	5 NM		1014.8	13.9	19.4	6	11.5	33	5	10
TONSINA	KJDG	7	49.4 N	128.9 W	18	09	M	40	1 NM	81		14.4	15.6	8	13	12	8	13
MANULANI	KNIJ	7	35.9 N	144.1 W	18	25		46	2 NM	81	1006.0	22.2	24.4	5	10	28	8	14.5
MICRONESIAN INDEPENDENCE	H9BQ	8	21.1 N	156.9 W	00	06	M	35	.25 NM	62	1014.0	27.0	27.0	2	8	05	5	11.5
OVERSEAS BOSTON	KRDB	8	45.3 N	126.9 W	00	16		35	.5 NM	55		17.8	16.0	5	14.5	17	11	23
USNS DE STEIGUER	NAEE	8	44.9 N	125.2 W	00	17	M	35	2 NM	62	1008.0	16.1	16.7	5	13	17	7	14.5
GREAT LAND	WFDP	8	53.8 N	135.0 W	15	05	M	38	1 NM	63	0987.5	13.3	11.1	4	6.5	08	7	10
SEALAND PRODUCER	WJBJ	9	38.4 N	169.6 W	06	25	M	37	10 NM		1013.4	24.4	24.4	XX	18	27	8	11.5
BAY BRIDGE	ELES7	10	53.5 N	175.3 W	00	34	M	36	2 NM		1003.0	11.0	8.0	12	14.5	36	8	11.5
CHEVRON COLORADO	KLHZ	10	39.6 N	124.7 W	18	34	M	40	5 NM		1012.0	15.0		9	13	35	11	14.5
MC-KINNEY MAERSK	OUZW2	10	39.2 N	127.1 W	18	01	M	36	10 NM		1023.0	16.4	15.9	3	19.5			
MAJESTIC MAERSK	OUJH2	11	40.1 N	162.4 E	00	15	M	45	1 NM	81	0997.6	23.9	20.0	7	19.5			
SEALAND NAVIGATOR	WPGK	11	45.3 N	161.0 E	06	06	M	35	1 NM		1004.0	10.0	13.9	4	5	06	9	8
SEALAND NAVIGATOR	WPGK	11	46.1 N	163.8 E	12	06	M	36	1 NM	59	1005.0	8.9	10.6	4	6.5	06	9	10
MAJESTIC MAERSK	OUJH2	12	41.9 N	174.8 E	00	21	M	36	1 NM	10	1009.4	21.2	17.6	6	13			
GEORGIA RAINBOW II	3ERJ8	12	29.0 N	118.7 W	12	06	M	37	2 NM	61	1011.0	20.0	16.0	9	24.5	09	7	8
1ST LT JACK LUMMIS	WJLV	12	20.2 N	174.9 E	12	09	M	40	2 NM		1015.0	27.8	28.0	3	6.5	13	3	8
MAJESTIC MAERSK	OUJH2	13	42.4 N	172.3 W	00	22	M	36	.5 NM	50	1003.2	19.9	18.1	5	18			
SOLAR WING	ELJS7	13	50.1 N	146.3 W	06	19	M	38	2 NM	61	1015.8	13.5	12.0	5	10	16	8	13
SEALAND KODIAK	KGTZ	13	57.1 N	149.1 W	18	16		38	5 NM		1004.2	13.5	13.2	4	10			
PRINCE WILLIAM SOUND	WSDX	14	47.3 N	131.5 W	06	35		36	5 NM		1022.0	15.6	16.1	6	8	36	8	8
SEALAND NAVIGATOR	WPGK	15	51.4 N	152.4 W	00	15	M	35	.5 NM		1005.5	11.7	11.7	5	6.5	15	12	11.5
SEA BELLS	ELCN7	15	46.2 N	165.1 E	18	12	M	40	.5 NM	65	0999.0	11.0	10.0	5	8	12	5	8
SEA BELLS	ELCN7	16	45.8 N	163.5 E	06	25	M	35	.5 NM		0988.0	10.0	10.0	10	16.5	25	10	16.5
SEALAND RELIANCE	WFLH	17	22.5 N	144.2 E	06	18		35	5 NM	15		29.4	30.0	4	6.5	16	6	8
MORELOS	XCMG	17	39.1 N	167.1 E	06	29	M	35	2 NM	16	1009.0	18.3	20.0	6	11.5	29	8	13
OVERSEAS VALDEZ	WOVS	17	23.5 N	144.7 E	09	16	M	40	5 NM		0993.5	30.0	28.9	19	8	15	8	10
OVERSEAS VALDEZ	WOVS	17	23.4 N	144.7 E	12	19	M	50	.25 NM	82	0996.0	30.0	28.9	5	13	15	8	16.5
OVERSEAS VALDEZ	WOVS	17	23.3 N	144.8 E	15	19	M	50	.25 NM	82	0994.0	30.0	28.9	6	11.5	15	10	16.5
DONAIRE	DUYV	18	46.1 N	161.0 W	00	20	M	36	2 NM	60	1011.4	17.0	13.0	7	21			
MARINE RELIANCE	WHEJ	18	29.0 N	130.8 E	18	03	M	35	5 NM	25	0998.5	28.5		7	14.5	10	9	16.5
SEALAND VOYAGER	KHRK	19	32.7 N	133.8 E	18	06	M	38	5 NM	50	0997.3	26.7	28.9	7	14.5	05	10	23
LNG AQUARIUS	WSKJ	20	23.4 N	131.5 E	06	27	M	35	5 NM	15	0990.0	29.0	29.4	5	6.5	28	10	13
PRESIDENT LINCOLN	KDBG	20	29.3 N	128.4 E	12	35		35	5 NM	02	0987.6	28.9	28.9	10	14.5	36	12	8
PRESIDENT LINCOLN	KDBG	20	30.3 N	130.2 E	18	03		42	5 NM	61		27.8	28.9	10	16.5	36	12	10
PRESIDENT LINCOLN	KDBG	21	31.5 N	131.7 E	00	07		40			0987.0	28.9	28.0	10	16.5	09	12	11.5
SEALAND PATRIOT	KHRF	21	33.2 N	127.7 E	06	04	M	50	5 NM	02	0995.5	26.0		4	8	04	8	14.5
SEALAND PATRIOT	KHRF	21	31.5 N	126.1 E	12	03		35	5 NM	02	0993.9	27.0		5	10	03	8	14.5
PRESIDENT POLK	WRYD	21	29.6 N	132.0 E	12	13	M	55	5 NM	05	0982.8	27.5	29.0	6	16.5	16	11	21
PRESIDENT POLK	WRYD	22	27.6 N	130.0 E	00	19	M	35	10 NM	02	0990.1	28.5	29.3	7	8	24	10	16.5
SEALAND RELIANCE	WFLH	22	48.2 N	167.6 W	18	14		37	5 NM	02	1021.8	11.7	10.0	2	5			
USNS NAVAJO	NOYK	23	34.3 N	120.4 W	00	11	M	36	5 NM		1013.8	17.8	20.6	2	6.5	31	4	16.5
PRESIDENT ADAMS	WRYW	23	41.4 N	161.5 E	00	22	M	40	.25 NM	43	0998.5	17.0	16.8	6	8	20	8	10
GEORGIA	3ERU6	23	52.0 N	169.3 W	04	22	M	38	1 NM	54	1013.0	11.5		12	21	12	8	13
CHEVRON PACIFIC	ELCO5	23	33.4 N	123.8 E	06	01	M	38	1 NM	52	0993.5	22.5	25.0	8	13	02	12	13
SEALAND RELIANCE	WFLH	23	48.2 N	161.8 W	06	15		35	10 NM	02	1025.4	12.2	10.6	3	10			
PRESIDENT KENNEDY	WRYE	24	36.5 N	144.5 E	12	05	M	35	10 NM		1007.0	21.1	23.3	6	8	05	6	11.5
NOSAC EXPRESS	LAZA2	25	53.7 N	150.8 W	00	20	M	42	.25 NM		1010.5	14.0	12.0	8	13	20	9	16.5
CAPE JUBY	WEBW	25	49.7 N	146.8 E	12	21		35			1018.0	14.4	12.2	4	10	21	6	13
GREAT LAND	WFDP	25	53.4 N	134.1 W	15	18	M	36	2 NM	62	1014.0	13.9	13.3	4	5	22	5	6.5
GREAT LAND	WFDP	25	54.2 N	135.6 W	18	19	M	39	1 NM	80	1004.0	15.0	14.4	3	5	23	7	10
SALINAS	3EPF3	26	49.9 N	131.7 W	06	24	M	38	.5 NM	45	1010.0	15.0	16.0	7	21			
NOSAC EXPRESS	LAZA2	26	54.1 N	162.9 W	06	26	M	43	5 NM		1010.0	10.5	10.0	8	13	26	10	19.5
USNS NAVAJO	NOYK	26	41.4 N	124.9 W	06	34	M	38	5 NM		1016.0	15.6		2	10	35	6	14.5
PRINCE OF TOKYO 2	3EUU6	27	46.9 N	168.1 E	18	16	M	40	200 YD	45	1000.5	14.0	4.0	19	23	16	20	24.5
PRINCE OF TOKYO 2	3EUU6	28	47.6 N	173.4 E	12	14	M	38	200 YD	45	1011.0	13.0	5.0	12	19.5	16	14	23
CAPE BORDA	WLBP	28	18.6 N	132.0 E	12	23		37	2 NM		1006.0	27.8	28.3	8	6.5	23	10	10
PRINCE OF TOKYO 2	3EUU6	28	47.8 N	175.3 E	18	14	M	38	200 YD	45	1013.4	13.0	6.0	19	23	14	20	24.5

July, August and September 1991

VESSEL	SHIP CALL	DATE	POSITION LAT. deg.	POSITION LONG. deg.	TIME GMT	WIND DIR. 10 deg.		WIND SPEED kts.	VSBY	PRES WX. code	PRESSURE mb	TEMP °C. Air	SEA Sea	WAVES PD sec	WAVES HGT ft.	SWELL DIR	SWELL WAVES PD sec	SWELL WAVES HGT. ft.
CAPE BORDA	WLBP	28	18.8 N	134.2 E	18	23		37	2 NM		1009.0	27.8	28.3	8	6.5	23	10	10
SEA FORTUNE	A8LL	29	50.7 N	173.7 E	00	18	M	37	50 YD	44	1011.0	13.0	14.0	18	11.5	18	10	11.5
MARINE RELIANCE	WHEJ	29	40.0 N	173.7 E	00	14	M	38	2 NM		1006.0	24.0		3	5	13	6	14.5
PRINCE OF TOKYO 2	3EUU6	29	48.3 N	179.1 E	06	15	M	38	200 YD	45	1015.7	13.5	6.0	17	23	15	18	24.5
MARINE RELIANCE	WHEJ	29	40.0 N	177.5 E	12	15	M	36	2 NM		1013.0	22.0		3	5	13	8	14.5
SEDCO/BP 471	D5BC	29	48.4 N	128.7 W	15	15	M	47	1 NM	63		16.1	14.5	6	13	15	8	10
GREAT LAND	WFDP	29	53.4 N	134.1 W	18	02	M	39	5 NM		0991.8	14.2	12.8	3	5	09	6	6.5
MARINE RELIANCE	WHEJ	29	40.0 N	179.4 E	18	18	M	38	2 NM		1016.0	23.0		3	3	16	6	13
ALLIGATOR HOPE	ELFN8	30	50.5 N	130.7 W	06	18	M	45	2 NM		0996.5	16.0	14.0	12	16.5	18	15	23
WESTWARD VENTURE	KHJB	30	50.9 N	129.6 W	06	17	M	40	5 NM		1001.0	17.8	12.8	1	6.5	22	5	10
PRINCE OF TOKYO 2	3EUU6	30	49.0 N	170.6 W	12	18	M	36			1015.5	13.0	6.0	12	23	16	18	24.5
SEALAND KODIAK	KGTZ	30	51.5 N	131.1 W	12	21	M	37	5 NM	50	1002.5	15.0	12.5	4	11.5	19	5	16.5
USNS NAVAJO	NOYK	30	43.8 N	125.8 W	12	18	M	40	5 NM		1013.9	16.8	16.7	2	14.5	19	3	16.5
MARIT MAERSK	OZFC2	31	37.2 N	147.9 E	06	19	M	39	10 NM		1011.9	29.0	27.7	8	13			
			ATLANTIC	AUG.														
EDYTH L.	C6YC	3	30.6 N	77.9 W	06	23	M	35	2 NM	97	1012.0	26.0	27.0	6	10	23	9	10
EDYTH L.	C6YC	5	18.2 N	86.7 W	06	11	M	35	5 NM	14	1013.5	28.4	28.0	3	5	13	8	8
SITHEA	LADO4	10	38.0 N	14.6 W	15	05	M	35	1 NM		1021.0	25.0	23.0	10	6.5	05	10	6.5
TYSON LYKES	WMLG	12	37.2 N	60.6 W	00	19	M	38	2 NM	81	1018.6	25.0		5	6.5	19	8	11.5
NANCY LYKES	WCUU	12	35.9 N	06.4 W	18	09		35	5 NM		1011.4	22.8	23.3	3	8	09	4	11.5
TROPICALE	ELBM9	30	13.4 N	69.7 W	03	09	M	36			1012.0	27.0	32.0	2	10	09	4	5
			GR. LAKES	SEP.														
EDGAR B. SPEER	WQZ9670	1	43.1 N	86.9 W	00	02	M	36	5 NM		1023.2	19.0	17.0	4	11.5			
CHARLES E. WILSON	WZE4539	9	45.4 N	83.1 W	21	16	M	40	5 NM			23.0	18.0	XX	5			
PHILIP R. CLARKE	WE3592	10	47.2 N	86.4 W	15	34	M	35	10 NM			14.0	14.0	2	6.5			
WILFRED SYKES	WC5932	12	42.3 N	87.8 W	15	18	M	35	10 NM		1013.2	19.0		3	5			
EDWIN H. GOTT	WXQ4511	14	47.5 N	87.4 W	21	12	M	38	2 NM	64		15.0	18.0	4	10			
EDWIN H. GOTT	WXQ4511	15	47.3 N	86.8 W	00	12	M	38	2 NM	62		16.0	18.0	4	10			
EDGAR B. SPEER	WQZ9670	16	47.4 N	89.3 W	15	24	M	38	10 NM			16.0	13.0	4	10			
PAUL R. TREGURTHA	WYR4481	16	47.5 N	88.7 W	15	28	M	36	10 NM	03		16.0	16.0	6	11.5			
GEORGE A. STINSON	WXR2336	16	47.0 N	90.9 W	18	24	M	35	10 NM	02		14.0	10.0	5	13			
PAUL R. TREGURTHA	WYR4481	16	47.3 N	89.3 W	18	25	M	45	10 NM	20		15.0	16.0	6	10			
CHARLES E. WILSON	WZE4539	16	47.5 N	87.9 W	18	24	M	40	10 NM	25		16.0	14.0	XX	8			
ROGER BLOUGH	WZP8164	16	45.9 N	84.8 W	21	25	M	45	10 NM			19.0	16.0	3	6.5			
MIDDLETOWN	WR3225	17	47.5 N	89.3 W	00	26	M	40	10 NM			16.0	18.0	6	11.5			
PAUL R. TREGURTHA	WYR4481	17	47.1 N	90.3 W	00	31	M	40	10 NM	01		11.0	17.0	4	6.5			
STEWART J. CORT	WYZ3931	17	47.5 N	88.0 W	00	27	M	40	10 NM			16.0	15.0	XX	10			
CHARLES E. WILSON	WZE4539	17	46.5 N	85.5 W	03	28	M	45	10 NM			15.0	14.0	XX	5			
ROGER BLOUGH	WZP8164	17	45.3 N	86.1 W	03	24	M	38	10 NM	02		16.0	17.0	5	8			
PAUL R. TREGURTHA	WYR4481	18	47.6 N	88.3 W	12	27	M	37	10 NM			10.0	15.0	5	8			
AMERICAN REPUBLIC	WYR5386	18	44.8 N	82.8 W	12	20	M	38				19.0	18.0	XX	5			
AMERICAN REPUBLIC	WYR5386	18	44.2 N	82.6 W	15	22	M	36	10 NM			17.0	21.0	XX	6.5			
EDGAR B. SPEER	WQZ9670	18	46.4 N	85.0 W	18	23	M	39	10 NM			10.0	13.0	4	8			
TRITON	WTU2310	18	45.9 N	84.7 W	18	27	M	35	10 NM			11.0		XX	3			
PAUL R. TREGURTHA	WYR4481	18	47.3 N	86.5 W	18	26	M	46	10 NM	24		8.0	15.0	7	11.5			
PAUL R. TREGURTHA	WYR4481	18	47.0 N	85.7 W	21	26	M	42	10 NM			8.0	15.0	7	11.5			
BURNS HARBOR	WQZ7049	22	47.1 N	90.9 W	18	24	M	40	10 NM			9.0	10.0	6	6.5			
PAUL R. TREGURTHA	WYR4481	22	47.3 N	89.6 W	21	25	M	36	10 NM	01		11.0	14.0	7	8			
ALPENA	WAV4647	23	47.3 N	89.3 W	00	26	M	45	10 NM	01		11.0	11.0	2	14.5			
EDGAR B. SPEER	WQZ9670	23	47.3 N	89.6 W	00	24	M	40	10 NM			10.0	13.0	4	16.5			
PAUL R. TREGURTHA	WYR4481	23	47.2 N	90.1 W	00	26	M	41	10 NM	03		10.0	14.0	6	10			
EDGAR B. SPEER	WQZ9670	23	47.2 N	90.2 W	03	27	M	36	10 NM			9.0	12.0	4	8			
MIDDLETOWN	WR3225	23	47.5 N	88.1 W	03	25	M	44	10 NM			10.0	12.0	4	14.5			
COLUMBIA STAR	WSB2018	23	47.3 N	87.0 W	03	27	M	46	10 NM	03		13.0	9.0	9	11.5			
PAUL R. TREGURTHA	WYR4481	23	47.1 N	90.9 W	03	27	M	36	10 NM	01		9.0	15.0	5	8			
MIDDLETOWN	WR3225	23	47.4 N	87.2 W	06	26	M	45	10 NM			10.0	12.0	5	16.5			
COLUMBIA STAR	WSB2018	23	47.5 N	87.7 W	07	29	M	48	10 NM	25		8.0	14.0	12	11.5			
EDWIN H. GOTT	WXQ4511	23	45.9 N	85.1 W	12	28	M	50	10 NM			12.0	17.0	5	11.5			
BUCKEYE	WAQ3520	25	47.4 N	87.2 W	15	16	M	40	5 NM	81		7.0	10.0	XX	11.5			
FRED R. WHITE JR	WAR7324	25	47.1 N	90.0 W	15	29	M	35	10 NM	60		8.0	6.0	6	8			
EDGAR B. SPEER	WQZ9670	25	45.0 N	86.5 W	15	25	M	36	10 NM			11.0	15.0	3	6.5			
ROGER BLOUGH	WZP8164	25	47.2 N	87.2 W	15	17	M	38	2 NM	62		8.0	15.0	6	10			
EDGAR B. SPEER	WQZ9670	25	44.2 N	87.0 W	18	22	M	40	2 NM			11.0	15.0	4	8			
EDWIN H. GOTT	WXQ4511	25	45.5 N	86.2 W	18	22	M	36	10 NM	51		11.0	18.0	8	10			

July, August and September 1991

VESSEL	SHIP CALL	DATE	POSITION LAT. deg.	LONG. deg.	TIME GMT	WIND DIR. 10 deg.	SPEED kts.	VSBY	PRES WX. code	PRESSURE mb	TEMP °C. Air	SEA Sea	WAVES PD sec	HGT ft.	SWELL DIR	WAVES PD sec	HGT. ft.
PHILIP R. CLARKE	WE3592	26	47.3 N	87.6 W	03	33	M 40	5 NM			7.0	7.0	XX	8			
EDGAR B. SPEER	WQZ9670	26	42.5 N	87.2 W	06	33	M 45	10 NM			14.0	15.0	4	6.5			
COLUMBIA STAR	WSB2018	26	45.2 N	86.6 W	06	32	M 37	> 25 NM	02		8.0	9.0	7	6.5			
BURNS HARBOR	WQZ7049	26	45.5 N	86.6 W	15	32	M 35	10 NM			6.0	14.0	3	5			
EDWIN H. GOTT	WXQ4511	26	46.7 N	84.9 W	18	31	M 38	5 NM			6.0	16.0	6	13			
EDWIN H. GOTT	WXQ4511	26	46.8 N	84.9 W	21	30	M 52	2 NM	52		5.0	16.0	7	16.5			
EDWIN H. GOTT	WXQ4511	27	46.9 N	85.2 W	00	31	M 44	2 NM	52		6.0	15.0	8	19.5			
CHARLES E. WILSON	WZE4539	27	44.1 N	82.6 W	00	29	M 42	2 NM	25		8.0	14.0	XX	14.5			
EDWIN H. GOTT	WXQ4511	27	46.9 N	85.5 W	03	33	M 36	5 NM			5.0	15.0	8	14.5			
EDWIN H. GOTT	WXQ4511	27	47.0 N	85.8 W	06	33	M 36	10 NM	50		6.0	13.0	7	11.5			
PAUL R. TREGURTHA	WYR4481	27	44.0 N	82.6 W	06	32	M 36	10 NM			7.0	16.0	6	10			
ST. CLAIR	WZA4027	27	45.2 N	83.2 W	06	30	M 35	10 NM	07		6.0	13.0	XX	8			
CHARLES E. WILSON	WZE4539	27	44.3 N	83.3 W	09	30	M 42	10 NM			7.0	15.0	XX	10			
CHARLES E. WILSON	WZE4539	27	45.6 N	83.8 W	12	31	M 37	10 NM			5.0	14.0	XX	6.5			
PAUL THAYER	WZE7718	29	45.0 N	83.2 W	18	29	M 35	5 NM	21		6.0	14.0	XX	5			
ROGER BLOUGH	WZP8164	30	45.3 N	85.2 W	03	11	M 38	2 NM			11.0	15.0	4	6.5			
EDWIN H. GOTT	WXQ4511	30	44.4 N	86.6 W	09	17	M 38	5 NM			13.0	17.0	4	11.5			
ALPENA	WAV4647	30	45.1 N	85.9 W	12	17	M 35	10 NM	29		12.0	15.0	4	6.5			
EDWIN H. GOTT	WXQ4511	30	43.9 N	86.7 W	12	17	M 38	5 NM			14.0	18.0	XX	11.5			
ST. CLAIR	WZA4027	30	46.7 N	84.9 W	12	13	M 44	10 NM			8.0	6.0	4	6.5			
EDGAR B. SPEER	WQZ9670	30	47.4 N	87.0 W	18	29	M 36	10 NM			10.0	12.0	3	6.5			
			PACIFIC	SEP.													
PACIFIC EMERALD	DUPG	1	42.6 N	152.7 E	00	27	M 44	.5 NM		0998.5	16.0	15.0	8	24.5	24	8	26
MARINE RELIANCE	WHEJ	1	37.9 N	154.2 W	18	21	M 38	10 NM		1016.5	22.0		4	5	36	6	3
GREEN ELLIOTT	3EWC	2	47.6 N	170.9 E	00	27	M 46	1 NM	07	0990.0	11.0	9.0	4	11.5	01	4	13
GREEN ELLIOTT	3EWC	2	47.6 N	172.3 E	06	34	M 35	5 NM		1000.0	12.5	10.0	5	11.5	34	7	14.5
WESTWARD VENTURE	KHJB	3	57.7 N	144.0 W	00	07	M 43	200 YD	81	1008.0	13.9	9.4	2	8	07	5	8
NATIONAL DIGNITY	DZRG	4	43.3 N	145.9 W	06	19	M 36			1013.0	19.0	17.0	8	16.5	19	8	16.5
SEALAND KODIAK	KGTZ	5	54.0 N	139.2 W	00	18	M 35	2 NM	10	1004.0	14.4	12.8	4	8	18	9	16.5
SEALAND PRODUCER	WJBJ	5	43.0 N	169.8 E	18	29	M 35	10 NM	02	1010.5	11.1	12.2	7	16.5	31	8	11.5
PRESIDENT EISENHOWER	KRJG	6	22.4 N	120.3 E	00	16	M 36	5 NM		1005.0	30.0	29.0	4	13	19	7	16.5
SEALAND PRODUCER	WJBJ	6	43.0 N	178.2 E	12	30	M 35	5 NM		1006.9	12.8	13.9	8	16.5	32	8	16.5
SALINAS	3EPF3	7	54.2 N	162.0 W	12	14	M 35	.5 NM			12.0	11.0	6	8			
CENTURY HIGHWAY #2	8JPE	7	42.1 N	154.2 W	18	17	M 36	2 NM	60	1011.5	18.5	17.0			17	7	11.5
SEALAND MARINER	KGJF	8	54.0 N	153.7 W	00	14	M 38	2 NM	61	1003.4	13.9		8	11.5	15	XX	13
SANKO PRELUDE	3EDP3	8	43.3 N	173.2 W	18	19	M 36	200 YD	44	1000.0	16.0	16.0	5	13	19	5	13
PRESIDENT TRUMAN	WNDP	8	31.4 N	143.3 E	18	16	M 40	10 NM		1003.0	26.7	28.7	3	14.5	16	10	18
CHEVRON COLORADO	KLHZ	8	40.5 N	125.3 W	23	35	M 37	10 NM	02	1015.6	16.7		2	13	35	4	13
SEALAND TACOMA	KGTY	9	54.0 N	156.2 W	00	19	M 35	10 NM	02	0996.6	11.1	10.0	3	8	18	9	10
CAPE BORDA	WLBP	9	37.5 N	124.4 W	18	32	38	5 NM		1013.2	16.1	16.7	8	5	33	8	13
DIANA	V7CP	10	43.4 N	160.6 E	23	36	M 37	2 NM		0996.5	12.5	15.0	7	10	01	8	11.5
SEA BELLS	ELCN7	11	45.0 N	167.6 E	00	06	M 38	200 YD	45	0998.0	11.0	13.0	5	6.5	06	6	8
SEA BELLS	ELCN7	11	45.3 N	167.8 E	06	06	M 38	200 YD	45	0998.0	11.0	13.0	5	8	06	6	10
SEALAND VOYAGER	KHRK	11	45.3 N	175.7 E	06	10	M 43	2 NM	50	0991.6	14.4	15.0	4	6.5	10	7	10
SEA BELLS	ELCN7	11	44.7 N	168.0 E	12	06	M 38	1 NM	41	0997.0	10.0	13.0	5	8	06	8	13
SEA BELLS	ELCN7	11	43.5 N	168.4 E	18	06	M 38	1 NM	41	0997.0	11.0	13.0	5	6.5	06	8	13
PRESIDENT JOHNSON	WVHS	11	49.7 N	178.8 W	18	09	M 36	2 NM	62	0998.0	13.3	7.8	7	10	13	10	16.5
YOUNG SPROUT	3EMQ3	12	50.8 N	179.7 E	00	02	M 44	.25 NM	65	0995.0	9.0	9.0	6	10	06	10	16.5
SEALAND VOYAGER	KHRK	12	45.1 N	177.5 W	00	20	M 36	1 NM	07	0978.0	12.8	15.6	4	6.5	17	11	19.5
YOUNG SPROUT	3EMQ3	12	50.9 N	179.9 E	06	02	M 40	.25 NM	65	0995.0	9.0	9.0	6	10	06	10	16.5
SEALAND VOYAGER	KHRK	12	45.5 N	175.8 W	06	21	M 38	1 NM	63	0975.1	12.2	15.6	5	6.5	20	19	36
PRESIDENT JOHNSON	WVHS	12	50.4 N	174.4 W	06	08	M 45	1 NM	63	0987.5	12.8	7.8	8	13	09	10	26
YOUNG SPROUT	3EMQ3	12	51.0 N	179.5 W	12	02	M 40	.25 NM	65	0999.0	10.0	9.0	6	10	04	10	16.5
SEALAND VOYAGER	KHRK	12	45.7 N	173.7 W	12	22	M 38	1 NM	63	0974.5	14.4	15.6	5	6.5	21	18	32.5
OVERSEAS BOSTON	KRDB	12	51.3 N	133.3 W	18	28	35	10 NM		1010.2	14.4	18.0	3	5	29	6	13
SEALAND VOYAGER	KHRK	13	46.5 N	168.9 W	00	25	M 37	2 NM	61	0981.9	13.3	15.0	3	5	24	16	26
OVERSEAS BOSTON	KRDB	13	52.4 N	135.2 W	00	30	35	10 NM	01	1009.1	17.2	18.0	3	5	29	6	13
SEALAND VOYAGER	KHRK	13	47.8 N	163.4 W	12	24	M 38	2 NM	50	0981.2	13.3	15.0	4	5	24	15	19.5
PRINCE OF TOKYO 2	3EUU6	14	52.3 N	153.7 W	00	18	M 35	5 NM	47	0989.0	12.5	6.0	8	8	18	7	8
SEALAND VOYAGER	KHRK	14	48.7 N	157.6 W	00	23	M 36	2 NM	51	0985.0	16.7	15.0	5	8	22	10	19.5
LNG TAURUS	WDZW	14	23.3 N	122.1 E	00	30	M 35	10 NM		1011.3	27.0	30.0	6	10	03	6	10
SEA BELLS	ELCN7	15	43.5 N	169.0 W	00	29	M 45	1 NM	41	0992.0	13.0	18.0	6	13	29	9	13
SEA BELLS	ELCN7	15	43.4 N	166.8 W	06	29	M 40	2 NM	41	0992.0	12.0	18.0	6	13	29	9	13
ARTHUR MAERSK	OXRS2	15	53.6 N	176.0 E	06	36	35	10 NM		1004.5	9.0		7	14.5			

July, August and September 1991

VESSEL	SHIP CALL	DATE	POSITION LAT. deg.	LONG. deg.	TIME GMT	WIND DIR. 10 deg.		SPEED kts.	VSBY	PRES WX. code	PRESSURE mb	TEMP °C. Air	SEA Sea	WAVES PD sec	WAVES HGT ft.	SWELL DIR	SWELL WAVES PD sec	SWELL WAVES HGT. ft.
PRESIDENT KENNEDY	WRYE	15	37.7 N	145.8 E	06	36	M	35	10 NM		1016.5	21.0	25.0	6	18	22	6	23
SEA BELLS	ELCN7	15	43.8 N	165.1 W	12	30	M	36	1 NM		0992.5	11.0	18.0	5	10	30	8	11.5
PINE FOREST	YJXL4	15	52.6 N	177.5 E	12	32	M	36	.5 NM	40	1002.0	8.5	9.0	7	10	32	7	10
SEA BELLS	ELCN7	15	44.1 N	164.4 W	18	30	M	36	1 NM		0992.5	12.0	18.0	5	10	30	8	11.5
SEALAND NAVIGATOR	WPGK	15	37.3 N	163.5 E	18	24		40	10 NM		1006.3	22.2	24.4	5	6.5	23	10	10
PINE FOREST	YJXL4	15	52.8 N	179.6 E	18	32	M	37	.5 NM	40	0996.0	8.5	9.0	8	8	32	9	10
SEA BELLS	ELCN7	16	44.5 N	161.2 W	00	28	M	36	2 NM		0998.0	13.0	17.0	5	11.5	28	6	11.5
SEALAND NAVIGATOR	WPGK	16	37.8 N	166.4 E	00	27	M	40	10 NM		1004.1	19.4	24.4	5	10	27	9	10
GREEN SAIKAI	3EVS5	16	41.6 N	171.4 E	06	03	M	35	200 YD		1000.0	14.0	12.0	11	14.5	06	12	14.5
SEA BELLS	ELCN7	16	44.3 N	159.1 W	06	28	M	36	5 NM		0998.0	13.0	17.0	5	11.5	28	6	11.5
SEALAND NAVIGATOR	WPGK	16	38.8 N	168.7 E	06	34	M	42	5 NM		1003.0	17.8	22.2	5	10	27	9	10
NOAA SHIP MILLER FREEMAN	WTDM	16	59.2 N	177.8 W	06	01	M	35	2 NM	25	0994.2	7.4	9.0	5	8	02	7	19.5
SEALAND NAVIGATOR	WPGK	16	39.7 N	170.8 E	12	01	M	38	5 NM		1009.2	11.7	19.4	5	10			
OVERSEAS BOSTON	KRDB	16	59.7 N	145.3 W	18	12		45	1 NM	55	1009.5	11.1		2	6.5	11	5	16.5
NATIONAL DIGNITY	DZRG	17	38.0 N	165.3 W	12	19	M	36	.5 NM	65	1012.5	22.0	23.0	4	6.5			
CHEVRON PACIFIC	ELCO5	19	33.2 N	138.6 E	00	17	M	47	2 NM	50	0991.5	28.0	27.0	6	18	16	10	13
PRESIDENT GRANT	WEZD	19	36.4 N	142.7 E	06	20		40	200 YD	65	0991.0	23.9	21.7	5	8	19	9	21
PRESIDENT GRANT	WEZD	19	36.2 N	142.1 E	12	17		40	2 NM	60		24.4	23.3	5	10	18	8	19.5
NATIONAL HONOR	DZDI	19	41.9 N	153.9 E	18	10	M	44	1 NM	65	1004.5	16.0	19.0	4	10	11	5	11.5
SEALAND HAWAII	KIRF	19	32.6 N	146.5 E	18	19	M	40	10 NM	03	1002.5	28.3	27.2	4	6.5	18	8	13
WECOMA	WSD7079	19	42.1 N	124.7 W	18	34	M	35	.25 NM	45	1013.0	12.2	10.8	5	8	29	11	8
GREEN RAINIER	3ENI3	20	44.9 N	155.7 E	00	07	M	40	2 NM	63	1007.8	12.5	13.6	5	6.5	14	5	6.5
ARCTIC TOKYO	5LJT	20	43.8 N	151.5 E	00	05	M	60	1 NM	82	0996.0	13.0		5	19.5			
ARCTIC TOKYO	5LJT	20	44.6 N	152.9 E	06	05	M	48	1 NM	82	0996.0	11.0	11.0	5	16.5			
PRESIDENT LINCOLN	KDBG	20	20.7 N	125.3 E	06	25		46	50 YD			27.8	30.0	12	16.5	25	16	28
ARCTIC TOKYO	5LJT	20	45.4 N	153.9 E	12	03	M	38	5 NM	03	1006.0	9.0	11.0	6	13			
PRESIDENT LINCOLN	KDBG	20	21.1 N	123.1 E	12	32		40	2 NM	15	1001.9	28.3	30.0	8	19.5	29	11	16.5
ARCTIC TOKYO	5LJT	20	46.2 N	155.6 E	18	36	M	35	5 NM		1012.0	8.0	10.0	2	10			
DONAIRE	DUYV	21	38.9 N	158.9 E	00	36	M	35	5 NM		1008.5	17.0	21.0	8	10	36	12	23
OVERSEAS BOSTON	KRDB	21	38.9 N	124.5 W	00	01		38	10 NM	01	1016.0	15.6	17.0	2	5	35	7	14.5
WECOMA	WSD7079	21	42.1 N	124.9 W	00	36	M	40	5 NM		1017.2	13.3	10.0	7	6.5	33	9	14.5
ASTRO JYOJIN	DVUL	21	44.9 N	150.7 W	06	19	M	41	1 NM	60	1008.3	17.0	16.0	8	18	15	7	10
ASTRO JYOJIN	DVUL	21	45.3 N	148.6 W	12	21	M	42	.5 NM		1009.3	18.0	16.0	8	11.5	13	8	10
NOAA SHIP MILLER FREEMAN	WTDM	21	58.6 N	176.8 W	21	01	M	40	2 NM	50	0996.0	7.0	8.6	2	6.5	02	6	10
ASTRO JYOJIN	DVUL	22	45.9 N	143.9 W	00	21	M	36	.5 NM		1013.0	18.0	16.0	6	11.5	18	8	11.5
SOLAR WING	ELJS7	22	37.7 N	179.5 W	00	31	M	39	10 NM		1008.8	17.0	21.0	10	21	32	12	23
SOLAR WING	ELJS7	22	37.6 N	179.1 E	06	34	M	36	10 NM		1013.8	17.0	23.0	10	16.5	30	10	19.5
NOAA SHIP MILLER FREEMAN	WTDM	22	57.2 N	173.8 W	15	04	M	36	5 NM	61	0982.0	9.8	9.5	3	5	09	8	10
ARCTIC TOKYO	5LJT	22	53.4 N	174.8 E	18	34	M	35	10 NM		0996.0	6.0	10.0	3	6.5			
NOAA SHIP MILLER FREEMAN	WTDM	22	56.9 N	173.3 W	18	03	M	43	5 NM	61	0978.0	8.2	9.6	5	6.5	10	7	16.5
NOAA SHIP MILLER FREEMAN	WTDM	22	56.7 N	172.7 W	21	04	M	50	2 NM	63	0975.0	7.5	9.1	4	6.5	08	8	21
COLIMA	DZST	22	36.1 N	125.5 W	22	03	M	45	1 NM	05	1016.0	19.0	18.0	6	5	32	12	11.5
			PACIFIC	SEP.														
ARCTIC TOKYO	5LJT	23	53.6 N	179.3 W	06	36	M	40	10 NM		0992.0	9.0	9.0	6	16.5			
GREAT LAND	WFDP	23	57.7 N	146.4 W	15	17		36	5 NM		1003.8	12.2	11.1	4	8	20	7	14.5
ARCTIC TOKYO	5LJT	23	53.6 N	174.5 W	18	35	M	35	1 NM		0994.0	8.0	10.0	15	24.5			
SOLAR WING	ELJS7	24	37.5 N	162.7 E	06	18	M	37	10 NM		1014.7	23.0	22.0	7	11.5	18	8	13
NOAA SHIP MILLER FREEMAN	WTDM	24	54.6 N	166.7 W	12	30	M	36	2 NM	53	0997.0	8.5	7.6	4	5	30	7	10
M.V. CALIFORNIA HERMES	ELJP6	27	46.7 N	176.7 W	00	26	M	38	5 NM	02	0989.5	11.0	12.0	10	16.5	26	12	16.5
PRESIDENT LINCOLN	KDBG	27	34.1 N	135.0 E	12	19		54	1 NM	82	0991.0	26.5	25.4	10	14.5	19	11	13
SEALAND PATRIOT	KHRF	27	29.5 N	132.7 E	12	23	M	40	2 NM		1007.5	29.0	25.0	6	8	21	14	16.5
CHEVRON MISSISSIPPI	WXBR	28	43.1 N	153.4 W	00	18		40	5 NM		1009.0	17.2	14.4	4	14.5	18	5	13
SEALAND PRODUCER	WJBJ	28	43.9 N	161.1 W	06	24	M	51	10 NM		1007.0	16.7	17.2	7	14.5	XX	XX	10
PRINCE OF TOKYO 2	3EUU6	28	43.1 N	151.9 E	12	33	M	47	5 NM	05	0992.5	15.5	6.0	14	23	33	14	23
PRINCE OF TOKYO 2	3EUU6	28	43.2 N	153.7 E	18	18	M	47	1 NM	11	0999.0	14.0	8.0	12	24.5	18	12	24.5
PRINCE OF TOKYO 2	3EUU6	29	43.4 N	157.5 E	06	30	M	53	5 NM	02	1008.5	12.0	9.0	14	26	29	14	26
ALLIGATOR HOPE	ELFN8	29	50.7 N	144.5 W	06	18	M	36	1 NM	50	1010.5	14.0	10.0	10	18	18	12	19.5
ANDERS MAERSK	OXIT2	29	43.5 N	171.5 E	06	25		37	2 NM	10	0996.0	16.0		6	13	24	12	19.5
PRINCE OF TOKYO 2	3EUU6	29	43.7 N	159.4 E	12	29	M	36	5 NM	03	1010.5	10.5	7.0	12	19.5	29	14	23
OVERSEAS BOSTON	KRDB	30	54.2 N	137.2 W	06	21		35	2 NM	21	1013.5	12.2		2	1.5	24	6	10
OVERSEAS BOSTON	KRDB	30	55.5 N	138.8 W	12	21		35	2 NM	21	1009.5	10.0		2	1.5	27	5	8
GREAT LAND	WFDP	30	58.6 N	149.0 W	18	20	M	36	10 NM		1011.1	13.9	10.6	3	5	21	8	14.5
			ATLANTIC	SEP.														
HUAL ANGELITA	LAFB4	4	46.7 N	35.4 W	00	14	M	48	5 NM	50	1016.3	19.0	16.0	19	14.5	14	19	14.5

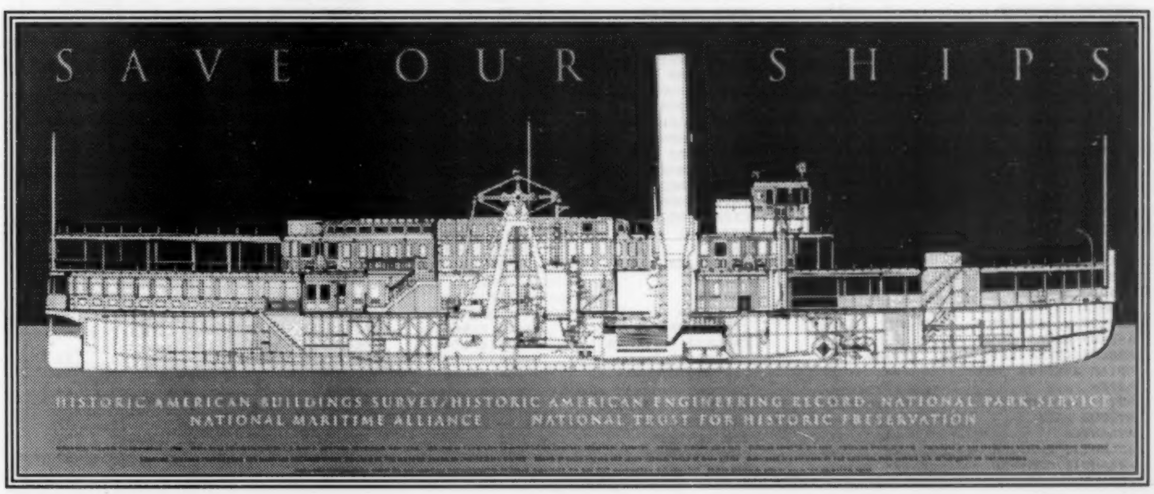
July, August and September 1991

VESSEL	SHIP CALL	DATE	POSITION LAT. deg.	LONG. deg.	TIME GMT	WIND DIR. 10 deg.	WIND SPEED kts.	VSBY	PRES WX. code	PRESSURE mb	TEMP °C. Air	SEA TEMP °C. Sea	WAVES PD sec	WAVES HGT ft.	SWELL DIR	SWELL WAVES PD sec	SWELL WAVES HGT. ft.
TROPICALE	ELBM9	6	13.2 N	69.6 W	05	08	M 37	10 NM	00	1013.0	28.0	32.0	4	8	08	4	8
CHARLOTTE LYKES	WPHZ	8	46.9 N	22.4 W	00	21	35	5 NM	01	1015.0	17.8	19.0	8	13	21	8	13
SEALAND ATLANTIC	KRLZ	12	41.3 N	49.3 W	12	24	35	5 NM	05	1008.3	28.0	20.5	11	24.5			
HUAL ANGELITA	LAFB4	16	46.1 N	24.4 W	00	27	M 35	5 NM	01	1018.0	18.0	18.0	21	11.5	27	21	11.5
HUAL ANGELITA	LAFB4	16	45.4 N	28.8 W	12	19	M 41	10 NM	02	1014.0	19.0	18.0	18	11.5	19	18	11.5
HUAL ANGELITA	LAFB4	16	45.0 N	30.8 W	18	19	M 40	5 NM	02	1010.0	17.0	18.0	21	13	19	21	13
MATHILDE MAERSK	OUUU2	19	49.5 N	38.9 W	06	26	M 38			1008.0	13.0	15.8	9	16.5			
MATHILDE MAERSK	OUUU2	19	49.8 N	35.2 W	12	27	M 37	5 NM	02	1006.0	14.0	13.9	8	11.5			
CHARLOTTE LYKES	WPHZ	20	45.0 N	30.3 W	00	30	35	5 NM	80	1013.0	16.7	17.0	6	13	30	10	16.5
USNS BARTLETT(T-AGOR 13)	NBAD	20	35.4 N	75.0 W	18	35	M 40	5 NM	58	1017.9	21.1	27.8	4	5	01	7	8
USNS JOHN LENTHAL	NJLN	22	17.3 N	70.7 W	13	09	M 37	1 NM	81	1015.4	24.4	28.9	2	6.5	10	6	5
USNS JOHN LENTHAL	NJLN	22	17.4 N	69.4 W	18	11	M 38	2 NM	16	1014.8	26.7	28.9	1	6.5	10	3	10
SEALAND ATLANTIC	KRLZ	23	50.5 N	02.0 W	12	23	M 35	1 NM	28	1012.0	23.0	16.9	6	10			
SEALAND ATLANTIC	KRLZ	24	49.5 N	06.8 W	00	24	M 36	10 NM		1011.7	20.0	17.1	8	11.5			
SEALAND ATLANTIC	KRLZ	25	46.2 N	18.9 W	06	31	35	5 NM	80	1014.0	15.0	18.0	5	10	31	11	19.5
NOAA SHIP DELAWARE II	KNBD	26	41.2 N	70.5 W	09	19	M 38	2 NM		1001.2	19.0	17.6	5	6.5	18	7	6.5
USNS JOHN LENTHAL	NJLN	28	30.2 N	79.6 W	18	04	M 37	10 NM	60	1020.0	26.7	28.9	1	6.5	08	2	10
USNS JOHN LENTHAL	NJLN	29	30.0 N	80.9 W	00	04	M 35	2 NM	18	1020.4	25.0	27.8	4	6.5	03	6	10

Save Our Ships Poster

The overall state of preservation of historic vessels is by no means the only challenge facing the maritime heritage community in America. But it is clearly among the most visible. As a group, large vessels are more at risk than any other class of historic resources. In order to draw attention to the plight of America's historic vessels, the Historic American Buildings Survey/Historic American Engineering Record (HABS/HAER) Division of the National Park Service, with the cooperation of the National Maritime Alliance and National Trust, has produced a handsome poster with the message Save Our Ships. The poster's image is a HABS/HAER measured drawing of the Lake Champlain paddle steamer ***Ticonderoga***, a designated National Trust Historic Landmark. The black and white inboard profile is printed on a background of blue and green, on heavy coated stock. Individual copies are available for $10 each postpaid and shipped in a heavy tube. Quantities are available at wholesale. For more information or to order write:

Maritime Office, National Trust
1785 Massachusetts Av., NW
Washington, DC 20036



July, August and September 1991

	RADIO	MAIL
1ST LT ALEX BONNYMAN	26	28
1ST LT JACK LUMMIS	34	60
2ND LT. JOHN P. BOBO	2	70
A.S.L. CYGNUS	30	
ACE ACCORD	30	
ACONCAGUA	18	
ACT 10	103	
ACT 11	25	
ACT 4	122	
ACT 5	52	
ACT 6	164	
ACT 7	229	
ACT I	148	
ADABELLE LYKES	57	157
ADDIRIYAH	11	
ADMIRAL WILLIAM M. CAL	8	
ADMIRALTY BAY	20	18
ADRIAN MAERSK	7	
ADRIANE-E	7	
AGENT	69	157
AIDE	55	1
AINO	72	71
AL AHMADIAH	32	
AL WATTYAH	14	
ALASKA RAINBOW	64	112
ALBERT MAERSK	18	
ALDEN W. CLAUSEN	73	214
ALEMANIA EXPRESS	154	
ALISON LYKES	43	
ALLIGATOR COLUMBUS	53	20
ALLIGATOR EXCELLENCE	48	
ALLIGATOR FORTUNE	35	18
ALLIGATOR HOPE	55	164
ALLIGATOR JOY	23	
ALLIGATOR LIBERTY	48	
ALLIGATOR PRIDE	40	101
ALLIGATOR TRIUMPH	48	
ALMERIA LYKES	37	
ALPENA	61	97
ALPHA HELIX	111	108
ALTAMONTE	5	
ALVA MAERSK	12	
AMBASSADOR		42
AMBASSADOR BRIDGE	65	46
AMERICA EXPRESS	65	
AMERICAN CONDOR	43	9
AMERICAN CORMORANT	7	27
AMERICAN EAGLE	68	70
AMERICAN FALCON	58	64
AMERICAN KESTREL	38	45
AMERICAN REPUBLIC	39	28
AMERICAN TRADER	37	79
AMERICANA	25	60
AMERIGO VESPUCCI	17	55
AMOCO CAIRO	38	
ANDERS MAERSK	43	108
ANGLO ORION	103	79
ANTHONY RAINBOW	15	11
AQUA CITY	1	
ARABIAN SENATOR	193	
ARCO ALASKA	31	
ARCO ANCHORAGE	13	15
ARCO CALIFORNIA	14	12
ARCO FAIRBANKS	13	13
ARCO INDEPENDENCE	43	38
ARCO JUNEAU	29	
ARCO SAG RIVER	14	
ARCO SPIRIT	6	19
ARCO TEXAS	29	37
ARCTIC DISCOVERER		284
ARCTIC OCEAN	44	49
ARCTIC TOKYO	37	138
ARGONAUT	38	113
ARILD MAERSK	17	
ARMCO	52	35
ARNOLD MAERSK	29	60
AROSIA	79	
ARTHUR M. ANDERSON	119	107
ARTHUR MAERSK	26	63
ASHLEY LYKES	43	
ASIAN SENATOR	33	
ASPEN	7	15
ASTRO JYOJIN	121	138
ATIGUN PASS	9	
ATLANTIC	51	
ATLANTIC CARTIER	49	
ATLANTIC COMPASS	74	

	RADIO	MAIL
ATLANTIC CONVEYOR	105	
ATLANTIC OCEAN	140	137
ATLANTIC SENTRY	28	84
ATLANTIS II	28	
ATLAS HIGHWAY	23	
AUSTRAL LIGHTNING	29	13
AUSTRAL RAINBOW	10	8
AXEL MAERSK	62	69
B.T. ALASKA	18	70
B.T. SAN DIEGO	3	
BAAB ULLAH	61	
BACTAZAR	23	13
BALTIMORE TRADER	56	138
BANNER	11	109
BAR' ZAN	16	
BAY BRIDGE	96	146
BEATE OLDENDORFF	40	
BEBEDOURO	43	
BELGIAN SENATOR	68	
BIBI	120	
BLUE HAWK	72	
BOGASARI LIMA	52	
BOHOL SAMPAGUITA	12	
BONN EXPRESS	57	
BRIGIT MAERSK	1	
BRILLIANT ACE	17	
BROOKLYN BRIDGE	53	45
BROOKS RANGE	28	
BUCKEYE	71	72
BUNGA KANTAN	41	
BUNGA KENANGA	62	
BUNGA KESIDANG	12	
BUNGA MELAWIS	1	
BURNS HARBOR	433	338
CALCITE II	234	202
CALGA	36	
CALIFORNIA	15	90
CANADIAN RAINBOW	50	47
CAPE ALEXANDER	6	
CAPE ANN	7	26
CAPE ARCHWAY	30	
CAPE BLANCO	76	160
CAPE BON	34	
CAPE BORDA	120	111
CAPE BOVER	57	138
CAPE BRETON	44	33
CAPE CANAVERAL	8	15
CAPE CANSO	11	
CAPE CATOCHE	77	
CAPE CHARLES	17	
CAPE CLEAR	17	
CAPE COD	15	
CAPE DIAMOND	43	
CAPE DOMINGO	41	
CAPE DUCATO	59	
CAPE EDMONT	93	22
CAPE FLATTERY	1	
CAPE FLORIDA	25	
CAPE GIBSON	6	47
CAPE GIRARDEAU	91	122
CAPE HENRY	51	37
CAPE HORN	84	24
CAPE HUDSON	72	
CAPE INSCRIPTION	56	34
CAPE ISABEL	23	
CAPE JOHNSON	36	60
CAPE JUBY	152	123
CAPE LAMBERT	48	69
CAPE LOBOS	31	
CAPE MENDOCINO	16	
CAPE MOHICAN	4	
CARIBE 1		44
CARLA A. HILLS	43	82
CARLIVALE	5	
CARMAN	9	
CARMEL	33	
CAROLINA		27
CARTAGENA	58	145
CASON J. CALLAWAY	156	174
CELEBRATION	18	
CENTURY HIGHWAY #2	167	84
CENTURY HIGHWAY NO. 5	220	
CGM ILE DE FRANCE	120	13
CGM LORRAINE	42	
CGM PASTEUR	10	
CGM PROVENCE	142	
CHABLIS	68	

	RADIO	MAIL
CHACO	10	
CHALLENGER	47	
CHARLES E. WILSON	249	230
CHARLESTON	58	57
CHARLOTTE LYKES	110	200
CHELSEA	10	
CHEMICAL PIONEER	34	61
CHESAPEAKE TRADER	18	
CHESNUT HILL	28	21
CHEVRON ANTWERP	6	21
CHEVRON ARIZONA	6	1
CHEVRON CALIFORNIA	190	140
CHEVRON COLORADO	60	87
CHEVRON EDINBURGH	8	98
CHEVRON FELUY		118
CHEVRON HORIZON		233
CHEVRON LOUISIANA	5	33
CHEVRON METEOR	1	
CHEVRON MISSISSIPPI	41	102
CHEVRON NAGASAKI		105
CHEVRON OREGON	5	
CHEVRON PACIFIC	12	52
CHEVRON SKY		166
CHEVRON STAR		170
CHEVRON SUN		63
CHEVRON WASHINGTON	30	41
CHICKASAW	58	53
CHINA CONTAINER	28	43
CHINA GLORY	36	
CHINA PRIDE	3	
CHIQUITA BOCAS	32	
CHO YANG SUCCESS	23	73
CLEMENT	79	
CLEMENTINA	25	
CLEVELAND	67	53
CO-OP EXPRESS III	41	
COASTAL MANATEE	4	14
COLIMA	8	38
COLUMBIA STAR	121	105
COLUMBINE	22	24
COLUMBUS AMERICA	59	
COLUMBUS AUSTRALIA	138	
COLUMBUS LOUISANA	147	
COLUMBUS NEW ZEALAND	92	
COLUMBUS OHIO	49	
COLUMBUS OLIVOS	17	32
COLUMBUS ONTARIO	111	
COLUMBUS QUEENSLAND	116	
COLUMBUS VICTORIA	227	
COLUMBUS VIRGINIA	215	
COLUMBUS WELLINGTON	167	
COMPANION EXPRESS	41	
CONCERT EXPRESS	74	
CONSENSUS SEA	15	
CONTIENTAL WING	83	26
CONTSHIP SPAIN	5	
CORAH ANN	39	19
CORNHUSKER STATE	37	
CORNUCOPIA	26	102
CORONADO	7	15
CORWITH CRAMER	4	
COURIER	53	
COURTNEY BURTON	37	59
CPL. LOUIS J. HAUGE JR	13	19
CRISTOFORD COLOMBO		25
CRISTOFORO COLOMBO	31	58
CSS HUDSON	97	
DAN MOORE	6	8
DEL MONTE	9	25
DEL MONTE HARVESTER	19	46
DELAWARE TRADER	23	64
DIAMOND STATE	45	
DIANA	9	43
DON JORGE	11	
DONAIRE		252
DSR OAKLAND	100	
DSR YOKOHAMA	163	
DUSSELDORF EXPRESS	76	
EASTERN GLORY	26	
EASTERN VENTURE	62	92
ECSTASY	51	34
EDEN	39	44
EDGAR B. SPEER	237	209
EDWARD L. RYERSON	59	39
EDWIN H. GOTT	249	252
EDYTH L.	65	86
EDYTH.L.	13	

	RADIO	MAIL
ELIZABETH LYKES	36	66
EMERALD SEA	128	104
ENDEAVOR	102	151
ENGLISH STAR	131	
ENSOR	46	88
EQUALITY STATE	48	
ESSO PALM BEACH	1	
ESSO PUERTO RICO	30	
ETERNITY	51	19
EUROPEAN SENATOR	45	
EVER GAINING	4	3
EVER GALLANT	8	
EVER GENTLE	3	
EVER GIANT	7	
EVER GLOWING	14	4
EVER GOING	9	
EVER GOODS	6	61
EVER GRAND	6	
EVER GREET	1	26
EVER GROWTH	5	15
EVER GUARD	6	
EVER GUEST	9	6
EVER LAUREL	3	
EVER LEVEL	5	6
EVER LINKING	9	3
EVER LOADING	1	30
EVER LYRIC	10	2
EVER VITAL	18	93
EXPORT FREEDOM	33	
EXPORT PATRIOT	38	85
EXXON BATON ROUGE	21	
EXXON BENICIA	30	37
EXXON CHARLESTON	7	
EXXON LONG BEACH	13	10
EXXON MEDITERRANEAN	1	
EXXON NEW ORLEANS	6	
EXXON NORTH SLOPE		3
EXXON PHILADELPHIA	15	
EXXON SAN FRANCISCO	6	2
EXXON WILMINGTON		13
FAIRLIFT	26	
FAIRWIND	1	
FANTASY	2	
FARNELLA	240	
FAUST	43	52
FERNCROFT	161	114
FESTIVALE	15	
FETISH	127	167
FLICKERTAIL STATE	74	4
FLORIDA RAINBOW	56	133
FORTALEZA	71	141
FRANCES HAMMER	70	45
FRANCES L.	41	111
FRANCES.L.	3	
FRANCIS SINCERE NO. 6	30	32
FRED R. WHITE JR	27	49
FUJI	49	59
GALVESTON BAY	34	45
GEMINI	34	46
GENEVIEVE LYKES	28	
GEORGE A. SLOAN	54	68
GEORGE A. STINSON	124	124
GEORGE WASHINGTON BRID	202	83
GEORGIA	1	253
GEORGIA RAINBOW II	53	92
GERMAN SENATOR	76	
GERONIMO	22	38
GLACIER BAY	29	
GLOBAL FAME	29	
GLOBAL LINK	18	62
GLORIOUS SPICA	17	
GOLDEN ENDEAVOR	6	35
GOLDEN GATE BRIDGE	188	79
GOLDEN MONARCH	44	42
GOPHER STATE	11	
GREAT LAND	358	387
GREAT RIVER	21	62
GREEN BAY	64	
GREEN ELLIOTT		28
GREEN HARBOUR	29	42
GREEN ISLAND	51	
GREEN LAKE	30	
GREEN MAYA	4	
GREEN RAINIER	6	10
GREEN RIDGE	84	152
GREEN SAIKAI	14	127
GREEN SUMA	18	42
GREEN VALLEY	31	64
GREEN WAVE	4	
GUANAJUATO	34	
GUAYAMA	30	76
GULF SENTRY	18	31
GULF SPEED	4	
GULF SPIRIT	37	
GYRE	12	
HAKONE MARU	85	
HANEI SKY	5	
HANEI SUN	26	24
HANJIN BUSAN	20	
HANJIN CHEJU	3	
HANJIN CHUNGMU	16	17
HANJIN FELIXSTOWE	5	
HANJIN HAMBURG	2	
HANJIN HONG KONG	11	
HANJIN KEELUNG	15	
HANJIN KOBE	20	
HANJIN KUNSAN	3	
HANJIN KWANG YANG	7	
HANJIN LE HAVRE	14	
HANJIN LONG BEACH	9	
HANJIN MASAN	8	
HANJIN NEW YORK	26	
HANJIN POHANG	39	
HANJIN SAVANNAH	12	
HANJIN SEATTLE	7	
HANJIN SEOUL	25	22
HANJIN TONGHAE	14	
HANJIN YOKOHAMA	11	
HANNOVER	28	
HANNOVERLAND	58	
HANSA LUBECK	54	
HANSA VISBY	54	
HARMAC DAWN	1	
HAWAIIAN RAINBOW	29	
HEIDELBERG EXPRESS	55	
HELM STAR		56
HENRY HUDSON BRIDGE	197	
HERACLITUS	5	14
HERBERT C. JACKSON	13	13
HERMENIA	52	
HESIOD	1	
HIBISCUS	13	
HIRA II	43	
HOEGH CAIRN	19	
HOEGH CLIPPER	8	
HOEGH DENE	1	
HOEGH DUKE	2	
HOEGH DYKE	33	32
HOEGH MASCOT	8	58
HOEGH MIRANDA	16	41
HOLIDAY	8	11
HONOLULU	80	
HOWELL LYKES	49	57
HUAL ANGELITA	19	57
HUAL LISITA	80	100
HUMACAO	44	156
HUMBER ARM	4	3
HYUNDAI CHALLENGER	5	
HYUNDAI COMMANDER	28	35
HYUNDAI CONTINENTAL	38	
HYUNDAI EXPLORER	2	
HYUNDAI INNOVATOR	22	
HYUNDAI NO 102	8	
HYUNDAI PIONEER	13	
INDEPENDENT SPIRIT	137	
INDIAN OCEAN	12	4
INFANTA	133	
ISLA PUNA	12	28
ISLAND PRINCESS	56	
IST LT BALDOMERO LOPEZ	52	
ITAITE	33	
ITB BALTIMORE	90	209
ITB NEW YORK	91	81
ITB PHILADELPHIA	35	4
IVER EXPLORER	87	
IVER EXPRESS	58	
J. A.W. INGLEHART	50	62
J.L. MAUTHE	127	102
JACKSONVILLE	80	123
JADRAN EXPRESS	1	
JALAGOPAL	1	
JALISCO	34	112
JAMES LYKES	43	59
JAPAN ALLIANCE	82	43
JAPAN APOLLO	73	60
JAPAN RAINBOW 2	12	10
JAPAN SENATOR	55	
JEAN LYKES	65	
JO BIRK	50	
JO CLIPPER	93	
JO LONN	101	
JO OAK	7	
JO ROGN	7	
JOHN G. MUNSON	96	80
JOHN LENTHALL		45
JOHN LYKES	63	
JOHN YOUNG		69
JOSEPH H. FRANTZ	237	192
JOSEPH LYKES	41	
JOVIAN LILY	51	129
JOVIAN LUZON	41	48
JULIUS HAMMER	97	107
JUPITER	18	
KAIMOKU	25	104
KAINULA	54	87
KALIDAS	1	
KATHLEEN PEARCY	30	57
KAUAI	79	140
KAYE E. BARKER	129	152
KEE LUNG	1	60
KEISHO MARU	48	
KENAI	21	72
KENNETH E. HILL	23	72
KENTUCKY HIGHWAY	24	
KEYSTONE CANYON	122	112
KEYSTONER	18	19
KISO	90	
KITTANING	28	22
KOKUA	202	210
KOLN ATLANTIC	94	
LAKE	56	23
LASH ATLANTICO	21	35
LAUST MAERSK	22	29
LAWRENCE H. GIANELLA	76	108
LEE A. TREGUTHA	55	59
LEONARD J. COWLEY	29	
LERMA	180	
LESLIE LYKES	48	
LETITIA LYKES	18	30
LIBERTY STAR	32	62
LIBERTY SUN	110	138
LIBERTY WAVE	26	
LILAS	38	125
LINDOE MAERSK	16	
LIRCAY	6	
LNG AQUARIUS	28	151
LNG CAPRICORN	14	
LNG LEO	37	112
LNG TAURUS	38	135
LNG VIRGO	4	
LONG LINES	110	
LOUIS MAERSK	36	76
LOUISE LYKES	45	78
LT. ODYSSEY	39	
LURLINE	33	161
LYRA	79	64
M. P. GRACE	4	
M.V. CALIFORNIA HERMES	23	25
M.V. CHIQUITA CINCINNA	10	41
M.V. EVER GATHER	10	26
M.V. OOCL EVNVOY	24	24
M/V VERA ACORDE	15	32
MAASSLOT	163	
MACKINAC BRIDGE	152	50
MADISON MAERSK	14	35
MAERSK COMMANDER	60	
MAERSK CONSTELLATION	52	
MAERSK PINE	164	120
MAERSK SUN	19	
MAERSK TACOMA	2	
MAGALLANES	9	4
MAGIC	97	12
MAGLEBY MAERSK	28	41
MAJ STEPHEN W PLESS MP	129	117
MAJESTIC MAERSK	21	94
MALLORY LYKES	22	137
MANHATTAN BRIDGE	125	
MANUKAI	45	193
MANULANI	38	168
MAR TRANSPORTER II	16	
MARATHA MAJESTY	12	
MARATHIS PROVIDENCE	4	
MARCHEN MAERSK	8	50
MAREN MAERSK	31	
MARGARET LYKES	53	
MARGRETHE MAERSK	44	65
MARIE MAERSK	34	31
MARIF	29	23
MARINE RELIANCE	78	108
MARIT MAERSK	32	90
MARJORIE LYKES	45	64
MASON LYKES	41	102
MATHILDE MAERSK	34	59
MATSONIA	62	201
MAUI	134	110
MAURICE EWING	148	275
MAYAGUEZ	22	17
MC-KINNEY MAERSK	42	102
MEDALLION	37	
MEDUSA CHALLENGER	5	
MENINA BARBARA	6	52

	RADIO	MAIL
MERCANDIAN CONTINENT	53	38
MERCANDIAN SUN II	84	
MERCURY ACE	30	
MERIDA	68	92
MERKUR AMERICA	44	
MERKUR PORTUGAL	44	
METTE MAERSK	51	92
MICHIGAN HIGHWAY	17	
MICRONESIAN COMMERCE	42	19
MICRONESIAN INDEPENDEN	46	11
MIDDLETOWN	80	118
MINDORO SAMPAGUITA	3	
MINERVA	14	
MING ENERGY	2	
MING MOON	2	
MING OCEAN	17	
MING PLEASURE	11	
MING PROPITIOUS	23	
MING STAR	9	
MING SUN	11	
MITLA		15
MOANA PACIFIC	91	
MOANA WAVE	167	127
MOKU PAHU	119	151
MONTE CERVANTES	10	
MONTERREY	76	
MORELLO	6	
MORELOS	65	152
MORMACSKY	61	19
MORMACSTAR	33	6
MORMACSUN	73	77
MSC CHIARA	10	
MYRON C. TAYLOR	98	128
NANCY LYKES	38	89
NARA	90	78
NATIONAL DIGNITY	51	122
NATIONAL HONOR	23	120
NATIONAL PRIDE	26	24
NECHES	1	
NEDLLOYD BAHRAIN	63	
NEDLLOYD BALTIMORE	107	
NEDLLOYD BANGKOK	101	
NEDLLOYD BARCELONA	123	
NEDLLOYD CLARENCE	157	
NEDLLOYD HOLLAND	45	68
NEDLLOYD HUDSON	65	71
NEDLLOYD MADRAS	21	
NEDLLOYD MANILA	145	
NEDLLOYD ROTTERDAM	84	
NEDLLOYD ROUEN	172	
NEDLLOYD VAN CLOON	73	
NEPTUNE ACE	25	
NEPTUNE AMBER	73	55
NEPTUNE CORAL	17	
NEPTUNE CRYSTAL	57	96
NEPTUNE DIAMOND	111	
NEPTUNE GARNET	23	
NEPTUNE JADE	17	
NEPTUNE PEARL	97	
NEW HORIZON	94	82
NEW YORK SENATOR	60	
NEWARK BAY	55	57
NIPPON HIGHWAY	47	
NOAA DAVID STARR JORDA	33	19
NOAA SHIP CHAPMAN	257	96
NOAA SHIP DELAWARE II	340	349
NOAA SHIP DISCOVERER O	207	210
NOAA SHIP FERREL	59	
NOAA SHIP M. BALDRIDGE	3	
NOAA SHIP MCARTHUR	312	166
NOAA SHIP MILLER FREEM	329	399
NOAA SHIP MT MITCHELL	295	310
NOAA SHIP OREGON II	460	112
NOAA SHIP RAINIER	195	
NOAA SHIP SURVEYOR	202	87
NOAA SHIP T. CROMWELL		572
NOAA SHIP WHITING	319	329
NOBEL STAR	94	
NORTHERN LIGHT	21	61
NOSAC EXPLORER	22	44
NOSAC EXPRESS	60	35
NOSAC RANGER	43	98
NOSAC TAKAYAMA	118	107
NUEVO SAN JUAN	70	186
NURNBERG ATLANTIC	110	
OAXACA	94	
OCEAN ASPIRATION	29	
OCEAN BRIDGE	7	
OCEAN CHEER	19	
OCEAN COMMANDER #1	15	
OCEAN CONQUEROR	58	
OCEAN HIGHWAY	23	
OCEAN ISLAND	18	
OCEAN LILY	32	12

	RADIO	MAIL
OCEAN MASTER	1	
OCEAN SEL	10	
OCEAN SPIRIT	11	
OCEAN VICTOR	22	34
OCEANUS	2	
OGLEBAY NORTON	93	128
OLEANDER	97	36
OLIVE ACE	40	45
OMI CHARGER	27	27
OMI MISSOURI	52	86
OMI WABASH	21	
OOCL BRAVERY	125	
OOCL CHARGER	52	
OOCL EDUCATOR	50	
OOCL EXECUTIVE	60	73
OOCL EXPLORER	39	55
OOCL FAIR	18	22
OOCL FAITH	29	
OOCL FORTUNE	30	23
OOCL FRIENDSHIP	38	41
ORANGE BLOSSOM	100	113
ORANGE STAR	95	
ORCHID	34	164
OREGON RAINBOW II	37	110
ORIENTAL EXPLORER		2
ORIENTAL FERM	24	
ORIENTAL FREEDOM	97	
ORIENTAL PATRIOT	2	
ORION HIGHWAY	53	
OVERSEAS ALICE	7	
OVERSEAS BOSTON	2	138
OVERSEAS CHICAGO	3	
OVERSEAS HARRIET	9	
OVERSEAS JOYCE	53	
OVERSEAS JUNEAU		38
OVERSEAS MARILYN	36	15
OVERSEAS NEW ORLEANS	24	32
OVERSEAS NEW YORK	11	17
OVERSEAS OHIO	8	
OVERSEAS PHILADELPHIA		11
OVERSEAS VALDEZ	49	74
OVERSEAS VIVIAN	1	
PACASIA	45	
PACBARON	10	
PACDUCHESS	53	
PACDUKE	26	
PACGLORY	25	
PACIFIC EMERALD	46	33
PACIFIC PRINCESS	16	
PACIFIC SENTRY	1	
PACKING	51	
PACMERCHANT	15	
PACNOBLE	42	
PACOCEAN	4	
PACPRINCE	14	
PACPRINCESS	42	
PACQUEEN	53	36
PACSEA	7	
PACSTAR	21	6
PACSUN	10	
PACTRADER	7	
PAGA	10	
PAPAGO	83	
PAPYRUS	25	29
PARIS SENATOR	6	
PATRIOT	37	
PAUL H. TOWNSEND	40	
PAUL R. TREGURTHA	235	188
PAUL THAYER	41	27
PECOS	10	17
PEGGY 'DOW	86	
PELANDER	12	24
PENNSYLVANIA TRADER	65	88
PERMEKE	16	
PETER W. ANDERSON	88	
PETROBULK PROGRESS	132	201
PFC EUGENE A. OBREGON	53	71
PFC JAMES ANDERSON JR	5	11
PFC WILLIAM B. BAUGH	13	
PHAROS	63	
PHILIP R. CLARKE	190	199
PINE FOREST	10	66
PIONERS	4	106
POLAR ALASKA	4	103
POLYNESIA	241	177
POMEROL	5	
PONCE	47	95
POTOMAC TRADER	8	
PRESIDENT ADAMS	118	198
PRESIDENT ARTHUR	5	77
PRESIDENT BUCHANAN	18	43
PRESIDENT EISENHOWER	147	36
PRESIDENT F. ROOSEVELT	53	166
PRESIDENT GARFIELD	23	

	RADIO	MAIL
PRESIDENT GRANT	54	156
PRESIDENT HARDING	87	74
PRESIDENT HARRISON	88	38
PRESIDENT HOOVER	34	130
PRESIDENT JACKSON	103	16
PRESIDENT JEFFERSON	1	65
PRESIDENT JOHNSON	44	95
PRESIDENT KENNEDY	118	161
PRESIDENT LINCOLN	124	220
PRESIDENT MADISON	24	97
PRESIDENT MONROE	138	23
PRESIDENT POLK	167	174
PRESIDENT TRUMAN	28	148
PRESIDENT TYLER	56	124
PRESIDENT WASHINGTON	102	
PRESQUE ISLE	178	159
PRIDE OF TEXAS	43	22
PRINCE OF TOKYO	116	241
PRINCE OF TOKYO 2	115	223
PRINCE WILLIAM SOUND	39	34
PROSPERITY	7	22
PROSPERO	43	130
PUERTO CORTES	3	
PURITAN	178	
PVT FRANKLIN J. PHILLI	9	
QUALITY OF LIFE	22	
QUEEN ELIZABETH 2	152	
R.V. LAKE GAURDIAN	39	28
RAINBOW BRIDGE	62	16
RAINBOW HOPE	199	179
RALEIGH BAY	52	138
RANA M	56	155
RANGER	66	
RECIFE	49	
RED ARROW	31	
RESOLUTE	24	
RICHARD G MATTIESEN	106	
RICHARD REISS	23	55
RIMBA KERUING	1	
RIO FRIO	49	
RIO NEGRO II	51	
RISING STAR	21	6
ROBERT E. LEE	32	50
ROGER BLOUGH	90	152
ROSEBANK	71	
ROSETTA	34	
ROSINA TOPIC	33	
ROTTERDAM	16	
ROVER	77	186
ROWANBANK	32	
ROYAL PRINCESS	101	
RUBIN DOGA	35	30
RUBIN OCEAN	37	68
RUTH LYKES	28	29
S.T. CRAPO	34	
SABRINA	16	25
SALINAS	31	160
SAM HOUSTON	25	8
SAMU	32	123
SAMUEL L. COBB	46	
SAN MARTIN	29	
SAN MATEO VICTORY	27	80
SAN PEDRO	46	
SANKO PIONEER	23	
SANKO PRELUDE	5	29
SANKO ROBIN	1	
SANSINENA II	87	54
SANTA ANA	39	52
SANTA MARTA	56	
SANTOS	46	
SAPAI	2	
SATURN DIAMOND	78	
SAUDI DIRIYAH	1	
SAUDI HOFUF	7	
SAVANNAH	33	
SCAN	111	31
SCARAB	126	41
SCHACKENBORG	34	30
SEA BELLS	19	134
SEA COMMERCE	98	
SEA FAN	62	57
SEA FORTUNE	21	118
SEA FOX	37	
SEA LIGHT	43	53
SEA LION	272	128
SEA MERCHANT	390	
SEA TRADE	47	
SEA WOLF	344	329
SEALAND ACHIEVER	180	
SEALAND ANCHORAGE	24	58
SEALAND ATLANTIC	49	121
SEALAND CHALLENGER	39	31
SEALAND CONSUMER	71	153
SEALAND CRUSADER	51	35

	RADIO	MAIL
SEALAND DEFENDER	148	41
SEALAND DEVELOPER	6	
SEALAND DISCOVERY	29	43
SEALAND ENDURANCE	37	
SEALAND ENTERPRISE	221	238
SEALAND EXPEDITION	17	26
SEALAND EXPLORER	49	111
SEALAND EXPRESS	59	180
SEALAND FREEDOM	21	79
SEALAND HAWAII	83	212
SEALAND INDEPENDENCE	50	124
SEALAND INNOVATOR	94	158
SEALAND INTEGRITY	58	143
SEALAND KODIAK	16	17
SEALAND LIBERATOR	97	137
SEALAND MARINER	64	67
SEALAND NAVIGATOR	195	231
SEALAND PACIFIC	207	163
SEALAND PATRIOT	68	169
SEALAND PERFORMANCE	103	30
SEALAND PRODUCER	89	197
SEALAND QUALITY	63	98
SEALAND RELIANCE	83	181
SEALAND SPIRIT	77	69
SEALAND TACOMA	36	92
SEALAND TRADER	168	228
SEALAND VALUE	58	69
SEALAND VOYAGER	114	121
SEAWARD BAY		16
SEDCO/BP 471	267	159
SEMINOLE	43	45
SENATOR	37	60
SGT WILLIAM A BUTTON	25	33
SGT. METEJ KOCAK	99	119
SHELDON LYKES	69	
SHELLY BAY	50	134
SHENAHON	9	
SHIN BEISHU MARU	103	
SHINKASHU MARU	109	
SHIRAOI MARU	126	22
SHOSHONE SPIRIT	6	
SIERRA MADRE	11	30
SILVER CLIPPER	53	20
SILVER HILL	61	
SITHEA	18	51
SKANDERBORG	61	69
SKAUBORD	168	107
SKAUBRYN	140	
SKAUGRAN	149	30
SKODSBORG	14	37
SOARER CUPID	22	47
SOLAR WING	55	103
SONBAI	3	
SONORA	54	
SOREN TOUBRO	8	
SOUTHLAND STAR	142	
SPIRIT OF TEXAS	17	
SPRING BEAR	4	
SPRING BEE	29	
ST. CLAIR	15	23
STAR EAGLE	58	73
STAR EVVIVA	28	
STAR FLORIDA	76	
STAR FRASER	118	
STAR FUJI	73	
STAR GEIRANGER	11	
STAR GRAN	75	86
STAR GRINDANGER	14	
STAR HONG KONG	133	
STAR MARLINN	21	
STAR MASSACHUSETTS	10	25
STAR MERCHANT	8	83
STAR MERIT		9
STAR STRONEN	76	
STAR WILMINGTON	31	
STELLA LYKES	32	
STELLAR VENUS	15	
STENA TRAILER	29	
STEWART J. CORT	243	197
STONEWALL JACKSON	36	
STUTTGART EXPRESS	160	
SUE LYKES	13	
SUGAR ISLANDER	21	33
SUNBELT DIXIE	4	
SUNRISE RUBY	22	230
SWAN CAPE	3	
SWAN LAKE	80	
SWIFTNES	13	
SYOSSET	29	82
T.S.EMPIRE STATE	24	69
TABASCO	66	
TAI CHUNG	13	27
TAI CORN	32	51

	RADIO	MAIL
TAI SHAN	59	74
TAI SHING	31	
TAMPA	15	
TAMPA BAY	65	
TERNOZA	34	40
TEXACO GEORGIA	6	
TEXACO WESTCHESTER	14	
TEXAS	5	
TEXAS CITY SEA	5	20
TEXAS CLIPPER	28	
TEXAS TRADER	22	
THOMAS WASHINGTON	119	118
THOMPSON PASS		8
TILLIE LYKES	48	36
TOHZAN	17	
TOLUCA	5	1
TONSINA	8	64
TORRENS	19	
TOWER BRIDGE	121	
TRANSWORLD BRIDGE	78	30
TRIGGER	20	
TRITON	146	196
TROPIC SUN	2	1
TROPICALE	7	11
TUG MICHIGAN	51	58
TULSIDAS	5	
TYSON LYKES	47	96
UCHOA	218	199
ULTRAMAR	20	
ULTRASEA	12	147
UNAMONTE	33	
UNIVERSE	37	
URTE	191	18
USCGC ACACIA (WLB406)	5	5
USCGC ACTIVE WMEC 618	29	
USCGC ACUSHNET WMEC 16	83	
USCGC ALERT (WMEC 630)	4	
USCGC BASSWOOD (WLB 38	29	
USCGC BEAR (WEMC 901)	53	
USCGC BOUTWELL WHEC 71	27	
USCGC BRAMBLE (WLB 392	30	
USCGC CAMPBELL	24	
USCGC CHASE (WHEC 718)	8	
USCGC CITRUS (WMEC 300	30	
USCGC CONFIDENCE WMEC6	2	
USCGC COURAGEOUS	3	
USCGC EAGLE (WIX 327)	68	38
USCGC ESCAPE (WMEC 6)	15	
USCGC FIREBUSH WLB 393	24	
USCGC FORWARD	5	130
USCGC IRONWOOD (WLB 29	72	59
USCGC LEGARE	1	
USCGC MACKINAW	31	3
USCGC MALLOW (WLB 396)	38	
USCGC MARIPOSA	89	
USCGC MELLON (WHEC 717	24	
USCGC MUNRO	256	
USCGC NORTHLAND WMEC 9	117	124
USCGC PAPAW (WLB 308)	5	
USCGC PLANETREE	22	
USCGC POLAR STAR WAGB	199	443
USCGC RELIANCE WMEC 61	33	4
USCGC RUSH	20	
USCGC SEDGE (WLB 402)	12	6
USCGC SENECA	13	
USCGC SPENCER	5	
USCGC STEADFAST WMEC 6	12	
USCGC STORIS (WMEC 38)	1	
USCGC SUNDEW (WLB 404)	1	
USCGC SWEETBRIER WLB 4	79	
USCGC TAHOMA	82	
USCGC TAMPA WMEC 902	6	25
USCGC VALIANT (WMEC 62	14	
USCGC VENTUROUS WMEC 6	6	
USCGC VIGILANT WMEC 61	13	
USNS ALGOL	8	
USNS ALTAIR	10	
USNS APACHE (T-ATF 172	25	
USNS BARTLETT(T-AGOR 1	1	168
USNS BELLATRIX	6	
USNS CAPELLA	51	
USNS CHAUVENET TAGS 29	35	
USNS COMET	49	115
USNS DE STEIGUER	55	109
USNS DENEBOLA	11	
USNS GUS W. DARNELL	40	
USNS JOHN LENTHAL		33
USNS JOSHUA HUMPREYS	2	16
USNS KAWISHIWI	18	
USNS MERCURY	74	111
USNS METEOR	20	
USNS MOHAWK (T-ATF 170	56	
USNS NARRAGANSETT	34	61

	RADIO	MAIL
USNS NAVAJO	42	50
USNS POTOMAC	27	
USNS POWHATAN TATF 166	37	
USNS RANGE SENTINEL		8
USNS REGULUS	49	53
USNS SATURN T-AFS-10		44
USNS SEALIFT ARCTIC	21	
USNS SEALIFT ATLANTIC	166	113
USNS SEALIFT CARIBBEAN	82	
USNS SEALIFT CHINA SEA	25	
USNS SEALIFT IND'N OCE	3	
USNS SEALIFT MEDITERRA	55	
USNS VANGUARD TAG 194	101	
USNS WILKES T-AGS-33	46	
VIKING ACE	47	68
VINE	111	
VISHVA SIDDHI	3	
VISHVA VIKRAM	4	
WASHINGTON HIGHWAY	101	
WASHINGTON RAINBOW #2	22	2
WELLINGTON STAR	139	
WEST MOOR	97	
WESTWARD VENTURE	47	102
WESTWOOD ANETTE	62	97
WESTWOOD BELINDA	12	24
WESTWOOD CLEO	97	87
WESTWOOD JAGO	112	
WESTWOOD MARIANNE	21	77
WHITE ROSE	12	
WILFRED SYKES	36	49
WILLIAM R. ROESCH	18	22
WINDWARD	2	
WINDWARD SENTRY	28	135
WINTER MOON	27	
WINTER WAVE	1	
WORLD WING #2	47	26
WRIGHT	5	
YAMATAKA MARU	39	
YANKEE CLIPPER	113	
YOKOHAMA	34	13
YOUNG SKIPPER	13	
YOUNG SPROUT	44	108
ZEELANDIA	101	
ZIM AMERICA	34	
ZIM CALIFORNIA	39	
ZIM CANADA	46	
ZIM HONGKONG	41	
ZIM HOUSTON	30	
ZIM IBERIA	37	
ZIM KEELUNG	81	
ZIM KINGSTON III	263	
ZIM MARSEILLES	56	
ZIM MIAMI	37	
ZIM SAVANNAH	11	
ZIM TOKYO	14	

SUMMARY: GRAND TOTAL VIA RADIO
54976

GRAND TOTAL VIA MAIL 43851

TOTAL UNIQUE OBS 79004

TOTAL DUPLICATES 19823 (25.1%)

UNIQUE RADIO OBS.35153 (44.5%)

UNIQUE MAIL OBS. 24028 (30.4%)

Bathy–Tesac Data at NMC

July, August and September 1991

CALL SIGN	TOTAL	BATHY	TESAC	SHIP NAME
A8VI	58	58	0	PACDUCHESS
CBVM	19	19	0	VINA DEL MAR
CGBS	73	3	70	PARIZEAU
CGDV	169	169	0	W. TEMPLEMAN
CG2676	19	19	0	SHAMOOK
CG2680	34	34	0	MARINUS
CG2965	29	29	0	RICKER
C6HL8	1	1	0	ACT 10
C6JY6	60	60	0	ACT 4
C6JZ2	62	62	0	ACT 3
C6JZ3	70	70	0	ACT 6
DAKE	76	76	0	KOELN ATLANTIC
DA9100	184	184	0	NORDSEE
DBBH	49	0	49	METEOR
DGVK	91	91	0	COLUMBUS VICTORIA
DGZV	95	95	0	COLUMBUS VIRGINIA
DHCW	78	78	0	COLUMBUS WELLINGTON
DHOU	31	31	0	PURITAN
DIDA	7	7	0	ARIANA
DLEZ	36	36	0	YANKEE CLIPPER
D5BC	56	56	0	SEDCO/BP471
D5NZ	140	140	0	POLYNESIA
EBJV	1	1	0	CATALUNA
ELBX3	42	42	0	PACKING
ELED7	32	32	0	PACPRINCE
ELED8	23	23	0	PACPRINCESS
ELHL6	31	31	0	COLUMBUS OHIO
EREC	41	4	37	PRILIV
EREH	6	0	6	PRIBOY
ERET	62	58	4	GEORGE OUSHAKOV
ESGG	17	2	15	VYACHESLAV FROLOV
FAQV	3	3	0	BALNY
FITA	2	2	0	NOROIT
FNCZ	15	15	0	DELMAS SURCOUF
FNED	24	24	0	***
FNGS	8	8	0	LA FAYETTE
FNQB	27	27	0	ILE MAURICE
FNZO	18	18	0	RABELAIS
FPYO	2	2	0	CAP SAINT PAUL
FRFT	1	0	1	***
GPHH	42	42	0	FARNELLA
GXDE	17	17	0	SCYLLA
GYSA	38	38	0	FLINDERS BAY
GYSE	4	4	0	NEDLLOYD TASMAN
HPAN	52	52	0	MICRONESIAN COMMERCE
HPEW	11	11	0	PACIFIC ISLANDER
H9BQ	32	32	0	MICRONESIAN INDEPEN-DENCE
JBOA	44	44	0	KEIFU MARU
JCCX	80	80	0	CHOFU MARU
JDRD	51	51	0	SHOYO MARU
JDWX	63	63	0	KOFU MARU
JFDG	130	130	0	SHUMPU MARU
JFPQ	26	26	0	***
JGZK	45	45	0	RYOFU MARU
JITV	121	121	0	WELLINGTON MARU
JNSR	50	50	0	***
JPVB	72	72	0	SEIFU MARU
J8FN	1	1	0	ROWFN BANK
J8FO	51	51	0	ROSEBANK
KGJB	31	31	0	SEALAND DEFENDER
KGWU	16	16	0	TH. WASHINGTON
KIRH	46	46	0	SEA-LAND TRADER
KNBD	44	44	0	DELAWARE II
KNFG	74	74	0	SEA WOLF
KRGB	103	103	0	SEA-LAND ENTERPRISE
LADB2	52	52	0	SHAUGRAN
LADC2	73	73	0	SKAUBORD
LAJV4	31	31	0	SKAUBRYN
NBMO	1	1	0	MISSOURI
NBMR	1	1	0	KIRK
NBTM	19	19	0	POLAR STAR
NELP	1	1	0	JOSEPH HEWES
NGDF	10	10	0	MUNRO
NHTM	3	3	0	***
NICB	17	17	0	***
NIKA	24	24	0	SEALIFT ATLANTIC
NMEL	7	7	0	MELLON
NOTH	1	1	0	HALYBURTON
NRCB	29	29	0	EAGLE
NRUO	16	16	0	POLAR SEA
OWUO6	105	105	0	MOANA PACIFIC COBEN-HAVN
PGDI	98	98	0	NEDLLOYD MANILA
PGDY	7	7	0	NEDLLOYD MADRAS
PGEM	8	8	0	NEDLLOYD BARCELONA
PJJU	187	187	0	OLEANDER
SHIP	714	699	15	***
S6FK	6	6	0	SWAN REEFER
TFEA	1	1	0	BJARNI SAEMUNDSSON
TWR3	6	6	0	***
UFJN	9	0	9	VILNYUS
UFYN	21	0	21	KAPITAN SHAYTANOV
UINF	149	135	14	VLADIMIR PARSHIN
UJFO	52	28	24	MULTANOVSKIY PROF
UUPB	40	0	40	AKADEMIK N. SHOKALSKIY
UVMM	57	54	3	GAKKEL,YAKOV
VC9450	243	243	0	GADUS ATLANTICA
VC9616	141	141	0	LADY HAMMOND
VJBQ	13	13	0	ANRO AUSTRALIA
VJDI	30	30	0	IRON NEWCASTLE
VJDP	13	13	0	IRON PACIFIC
VKCV	31	31	0	DERWENT
VKDA	32	32	0	DARWIN
VKLA	3	3	0	ADELAIDE
VKLB	20	20	0	HOBART
VKLC	57	57	0	BRISBANE
VKML	56	56	0	SYDNEY
VKPT	31	31	0	PERTH
VLNB	86	86	0	TORRENS
V2PM	101	101	0	WEST MOOR
WCGN	43	43	0	CHEVRON CALIFORNIA
WLDZ	77	77	0	***
WPGK	37	37	0	NAVIGATOR
WPKD	63	63	0	SEA-LAND ACHIEVER
WRBA	9	9	0	PACMISRANFAC HAWAREA
WRBB	1	1	0	***
WSC2276	3	3	0	POINT SUR
WSRL	20	20	0	SEA-LAND PACIFIC
WTDM	195	176	19	M.FREEMAN
WTDO	13	5	8	OREGON II
WTEA	184	181	3	DISCOVERER
WTED	11	11	0	CHAPMAN
WTEF	12	12	0	RAINIER
WTEG	27	25	2	MOUNT MITCHELL
WTEJ	37	37	0	MCARTHUR
WTES	49	46	3	SURVEYOR
WTEW	15	13	2	WHITING
WTEZ	2	2	0	FERREL
WUS9293	35	35	0	MOANA WAVE
WXBR	42	42	0	CHEVRON MISSISSIPPI
WXQ7334	4	4	0	PETER ANDERSON
Y3CH	21	0	21	PROF. ALBRECHT PENCK
Y3CW	22	0	22	A. V. HUMBOLDT
ZCKP	21	21	0	STAR HONG KONG
ZDAZ	34	34	0	***
ZDBE9	25	25	0	VOYAGER
ZMCR	1	1	0	CANTERBURY
3DTP	39	39	0	SOUTHLAND STAR
3EET4	11	11	0	SEAS EIFFEL
7JOB	14	14	0	SHIN KASHU MARU
7KDD	20	20	0	YOKO MARU
9VUU	15	15	0	ANRO ASIA
9VVB	72	72	0	GOLDENSARI INDAH
32315	142	142	0	BUOY
32316	10	10	0	BUOY
32317	38	38	0	BUOY
32318	35	35	0	BUOY
51004	1	1	0	BUOY
51006	32	32	0	BUOY
51007	84	84	0	BUOY
51008	50	50	0	BUOY
51009	135	135	0	BUOY
51010	138	138	0	BUOY
51011	16	16	0	BUOY
51014	29	29	0	BUOY
52001	17	17	0	BUOY
52002	36	36	0	BUOY
52004	29	29	0	BUOY
52006	22	22	0	BUOY

TOTAL BATHYS RECEIVED 7238
TOTAL TESACS RECEIVED 388
TOTAL REPORTS RECEIVED 7626

NDBC Station Data Summary

July, August and September 1991

Wave observations are taken each hour during a 20–minute averaging period, with a sample taken every 0.67 seconds. The significant wave height is defined as the average height of the highest one–third of the waves during the average period each hour. The maximum significant wave height is the highest of those values for that month. At most stations, air temperature, water temperature, wind speed and direction are sampled once per second during an 8.0–minute averaging period each hour (moored buoys) and a 2.0–minute averaging period for fixed stations (C–MAN). Contact NDBC Data Systems Division, Bldg 1100, SSC, Mississippi 39529 or phone (601) 688–2838 for more details.

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
32302	18.0S	085.1W	0724	18.3	19.4	2.4	5.0	25/15	14.2	SE	24.9	30/18	1018.9
33301	56.3S	027.6W	0366	-6.8									995.6
41001	34.9N	072.9W	0743	26.2	26.6	1.4	3.2	03/20	11.5	SW	32.6	03/19	1016.7
41002	32.3N	075.2W	0744	27.4	27.7	1.2	3.0	03/09	10.5	SW	23.5	03/09	1017.6
41008	30.7N	081.1W	0743	27.4	28.6	0.6	1.7	17/00	9.6	SW	20.8	26/22	1016.9
41009	28.5N	080.2W	1484	27.5	28.4	0.6	1.2	01/01	8.7	S	20.8	04/23	1017.4
41010	28.9N	078.5W	1242	28.0	28.6	0.8	1.4	30/10	10.0	S	28.2	30/18	1018.6
42002	25.9N	093.6W	0684	28.4	29.4	0.6	2.1	07/07	8.0	SE	23.1	27/19	1016.3
42003	25.9N	085.9W	0739	28.0	29.4	0.5	1.1	04/20	6.7	SE	23.7	20/19	1017.8
42007	30.1N	088.8W	0716	28.1	29.7				9.1	SW	26.2	31/00	1016.4
42020	27.0N	096.5W	0136	28.3	29.3	0.7	2.0	01/00	8.1	SE	18.1	07/04	1014.0
44004	38.5N	070.7W	0742	23.6	24.0	1.0	2.5	30/11	9.0	SW	26.2	29/19	1015.7
44005	42.7N	068.6W	0741	17.0	15.4	0.8	2.0	08/01	7.7	SW	19.0	23/15	1013.8
44007	43.5N	070.1W	0744	18.1	16.0	0.4	1.3	08/08	8.4	S	20.6	09/18	1014.0
44008	40.5N	069.4W	0741	18.2	15.8	0.9	2.2	30/12	9.8	SW	26.2	06/07	1015.4
44009	38.5N	074.7W	0742	24.2	24.2	0.7	2.8	29/21	10.6	S	29.9	29/18	1014.9
44012	38.8N	074.6W	0740	23.9	23.7	0.7	2.4	29/22	10.6	S	27.8	29/18	1014.7
44013	42.4N	070.8W	0742	20.8	18.8	0.3	1.1	08/10	8.8	SW	21.4	24/01	1014.6
44014	36.6N	074.8W	0741	25.7	25.4	0.9	1.6	27/22	8.9	SW	20.2	26/20	1015.7
44025	40.3N	073.2W	0712	22.9	22.1	0.7	2.2	13/18	9.2	SW	30.5	13/17	1014.6
45001	48.1N	087.8W	0743	8.1	5.2				8.0	SW	21.2	17/05	1013.8
45002	45.3N	086.4W	0742	18.9	18.8	0.4	1.5	02/02	8.3	SW	19.6	06/11	1014.1
45003	45.3N	082.7W	0742	17.1	16.4				8.6	NW	26.2	06/23	1014.2
45004	47.5N	086.5W	0737	9.1	4.9	0.3	1.4	23/17	9.0	W	19.9	17/06	1014.1
45005	41.7N	082.4W	0743	23.6	24.7	0.4	1.3	02/02	7.7	W	27.2	08/03	1014.6
45006	47.3N	089.9W	0743	11.3	8.2	0.4	1.5	23/18	8.0	W	21.8	17/05	1014.7
45007	42.8N	087.1W	0741	22.0	22.3	0.5	2.0	14/03	9.7	S	21.8	21/10	1014.0
45008	44.3N	082.4W	0741	19.3	19.4	0.6	2.2	09/01	7.9	SW	18.2	09/00	1014.9
46001	56.3N	148.3W	0743	10.2	10.6	1.4	4.4	22/22	11.0	SW	27.8	22/15	1014.0
46002	42.5N	130.4W	0742	15.4	15.8	1.6	3.0	05/09	10.8	NW	23.3	05/06	1022.6
46003	51.9N	155.9W	0744	9.4	9.6	1.4	4.1	30/15	10.4	W	26.0	30/08	1017.4
46005	46.1N	131.0W	0742	14.1	14.5	1.5	2.8	14/21	10.7	NW	21.4	14/16	1021.1
46011	34.9N	120.9W	0743	13.8	14.5	1.4	2.7	26/19	7.3	NW	18.6	01/02	1015.7
46012	37.4N	122.7W	0042	13.4	13.6	1.2	1.6	30/06	8.1	S	11.7	30/21	1015.0
46013	38.2N	123.3W	0743	12.0	11.8	1.6	3.2	26/04	9.7	N	29.6	24/23	1014.8
46014	39.2N	124.0W	0742	11.8	11.9	1.9	4.2	26/02	10.7	NW	28.1	25/13	1015.2
46022	40.8N	124.5W	0744	11.4	10.9	1.9	5.1	05/02	8.9	N	22.2	09/10	1016.7
46023	34.3N	120.7W	0741	14.0	15.3	1.5	2.4	26/04	11.3	NW	24.0	14/09	1014.6
46025	33.8N	119.1W	0741	16.3	18.3	0.7	1.5	28/06	5.2	W	13.2	29/11	1014.6
46026	37.8N	122.7W	0744	12.3	13.4	1.1	2.1	25/03	8.2	W	21.2	25/08	1015.1
46027	41.8N	124.4W	0741	10.9	10.1	2.0	4.9	05/00	11.8	N	35.9	04/23	1015.9
46028	35.8N	121.9W	0742	13.6	14.1	1.8	3.2	06/09	8.8	NW	26.4	14/08	1015.8
46030	40.4N	124.5W	0738	11.1		1.8	4.3	05/04	13.6	N	23.3	04/12	1016.1
46040	44.8N	124.3W	0742	13.1	12.1	1.4	2.6	08/05	9.7	N	23.9	04/01	1019.1
46041	47.4N	124.5W	0742	13.1	13.1	1.2	2.4	04/18	8.1	NW	19.4	03/10	1019.3
46042	36.8N	122.4W	0744	13.1	13.6	1.5	2.6	01/15	8.0	NW	21.6	01/00	1015.6
46045	33.8N	118.5W	0743	17.0	18.3	0.6	1.2	29/06	5.1	SW	12.2	08/00	1014.6
51001	23.4N	162.3W	0742	25.7	26.4	1.7	2.7	17/16	12.7	E	20.2	11/23	1017.5
51002	17.2N	157.8W	0738	25.6		2.0	3.6	26/21	14.6	E	21.1	28/09	1014.5
51003	19.2N	160.8W	0180	26.0	26.9	1.1	1.6	08/12	8.3	E	13.6	05/12	1014.3
51004	17.4N	152.5W	0526	25.3	26.0	2.1	3.2	22/00	14.6	NE	22.6	26/12	1014.4
91222	18.1N	145.8E	0711	28.7					5.8	E	19.6	30/09	
91251	11.4N	162.4E	0726	28.1					10.3	E	20.4	07/05	1009.7
91356	5.4N	163.0E	0488	26.1					4.9	E	19.3	22/13	1009.3
91365	8.9N	165.8E	0740	27.8					8.2	E	24.8	23/21	1010.0
91377	6.1N	172.6E	0742	27.6					6.2	NE	21.7	11/09	1009.2
ALSN6	40.5N	073.8W	0736	23.0	22.3	0.7	2.2	13/18	11.6	SW	32.7	13/15	1015.3
BURL1	28.9N	089.4W	0744	28.3					8.1	W	38.3	15/05	1016.6
BUSL1	27.9N	090.9W	0264	29.4	30.9								1018.2
BUZM3	41.4N	071.0W	0741	20.5					11.8	SW	28.6	12/00	1015.6
CARO3	43.3N	124.4W	0743	12.1					7.7	NE	26.6	05/18	1018.3
CHLV2	36.9N	075.7W	0742	25.8	26.0	0.7	2.1	30/01	13.4	SW	41.4	01/00	1015.6
CLKN7	34.6N	076.5W	0721	27.2					9.7	SW	24.2	26/15	1016.2
CSBF1	29.7N	085.4W	0721	27.7					7.0	W	23.4	17/14	1016.8
DBLN6	42.5N	079.4W	0025	18.7					7.6	N	14.3	02/00	1024.3
DESW1	47.7N	124.5W	0743	13.0					9.2	W	26.1	15/11	1019.8
DISW3	47.1N	090.7W	0743	16.4					9.0	SW	28.7	17/03	1013.5
DPIA1	30.3N	088.1W	0743	28.0	29.9				7.4	SW	36.2	25/07	1016.8
DSLN7	35.2N	075.3W	0736	27.0	27.4	0.9	1.8	31/09	14.9	SW	33.7	29/13	1016.1
FBIS1	32.7N	079.9W	0743	27.8					8.7	SW	19.0	05/21	1016.4
FFIA2	57.3N	133.6W	0744	12.2					6.3	S	20.4	02/20	1017.7
FPSN7	33.5N	077.6W	0741	27.5	28.2				13.3	SW	29.0	05/05	1016.7
GBCL1	27.8N	093.1W	0738	28.2	30.1	0.5	1.5	07/08	8.1	S	26.9	06/11	1017.0
GDIL1	29.3N	090.0W	0744	27.8	30.3				7.0	SW	35.2	28/22	1016.7
GLLN6	43.9N	076.5W	0743	21.5					10.7	SW	26.0	30/03	1013.7
IOSN3	43.0N	070.6W	0744	19.9					10.7	W	24.0	09/14	1014.6
LKWF1	26.6N	080.0W	0744	27.6	29.3				7.7	SE	21.3	30/00	1017.8
MDRM1	44.0N	068.1W	0743	14.7					11.6	SW	29.0	23/15	1013.9
MISM1	43.8N	068.9W	0689	16.0					12.3	SW	25.3	23/14	1014.0
MLRF1	25.0N	080.4W	0744	28.7	30.1				7.6	SE	24.3	18/00	1017.4
MPCL1	29.4N	088.6W	0739	28.0	29.5	0.3	1.4	15/03	9.2	W	31.8	06/14	1016.7
NWPO3	44.6N	124.1W	0744	12.1					8.9	N	28.0	04/00	1018.9
ORKP2	7.6N	155.2E	0647	27.9					5.1	NE	28.2	05/20	1009.5
PILM4	48.2N	088.4W	0501	11.6					10.9	W	27.9	01/19	1011.7
PTAC1	39.0N	123.7W	0743	11.6					8.7	N	22.7	25/14	1015.3
PTGC1	34.6N	120.7W	0738	13.6					11.1	N	27.4	29/12	1015.2
ROAM4	47.9N	089.3W	0743	14.2	8.6				12.5	SW	32.1	19/03	1013.8
SAUF1	29.9N	081.3W	0485	26.2	28.5				7.7	SW	29.4	16/23	1017.5
SBIO1	41.6N	082.8W	0743	24.1					9.0	SW	23.1	24/02	1014.5
SGNW3	43.8N	087.7W	0743	20.5					9.4	S	26.7	29/14	1014.5
SISW1	48.3N	122.9W	0740	13.0					8.0	W	23.0	25/09	1019.4
SPGF1	26.7N	079.0W	0743	28.4	29.9				4.4	S	27.2	02/22	1017.7

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
SRST2	29.7N	094.1W	0743	28.2					8.8	S	23.0	07/10	1016.6
STDM4	47.2N	087.2W	0742	15.2					12.7	W	33.0	24/02	1016.2
TPLM2	38.9N	076.4W	0744	25.3	26.3				8.6	S	28.9	07/19	1015.0
TTIW1	48.4N	124.7W	0741	12.3					7.5	S	29.0	23/14	1020.3
WPOW1	47.7N	122.4W	0744	15.7					5.0	NE	15.9	24/20	1018.0
AUGUST		**1991**											
32302	18.0S	085.1W	0735	17.6	18.9	2.4	4.3	17/21	13.7	SE	23.7	01/06	1019.1
33301	56.3S	027.6W	0391	-5.7									1000.7
41001	34.9N	072.9W	0735	26.4	27.2	1.3	7.8	19/06	10.5	SW	36.1	19/03	1017.9
41002	32.3N	075.2W	0740	27.3	28.0	1.3	8.4	18/17	10.3	SW	46.8	18/17	1017.7
41008	30.7N	081.1W	0737	27.2	28.1	0.6	1.9	01/15	8.7	S	21.6	20/12	1017.6
41009	28.5N	080.2W	1473	27.6	28.1	0.6	1.7	17/17	8.2	S	25.8	11/01	1017.6
41010	28.9N	078.5W	0956	28.5	29.0	0.8	3.0	17/20	10.6	S	34.0	17/19	1017.7
41017	35.4N	075.1W	0058	26.6	27.5	0.7	0.9	30/18	7.6	SW	13.6	31/22	1017.4
42001	25.9N	089.7W	0414	28.2	29.4	0.4	0.8	16/16	7.9	SE	22.7	16/15	1016.0
42002	25.9N	093.6W	0704	28.5	29.7	0.5	1.1	16/07	8.1	SE	25.3	18/15	1016.1
42003	25.9N	085.9W	0739	28.4	29.6	0.5	1.2	01/18	7.3	E	18.5	01/14	1017.6
42007	30.1N	088.8W	0718	28.1	29.7				8.4	SW	24.1	12/00	1016.6
42019	27.9N	095.0W	0411	28.5	29.6	0.6	1.1	15/19	8.2	E	27.2	31/15	1015.3
42020	27.0N	096.5W	0435	28.9	29.6	0.6	1.3	27/03	9.5	SE	17.7	27/02	1015.1
44004	38.5N	070.7W	0232	24.0	24.4	1.1	2.1	03/11	9.0	W	26.0	10/16	1016.8
44005	42.7N	068.6W	0456	18.7	17.9	1.0	6.6	19/23	10.5	SW	44.1	19/22	1013.2
44007	43.5N	070.1W	0736	18.2	16.0	0.6	5.8	20/00	10.5	SW	42.0	19/21	1015.3
44008	40.5N	069.4W	0736	20.3	18.0	1.1	11.4	19/20	10.9	SW	47.0	19/19	1017.7
44009	38.5N	074.7W	0737	24.6	24.7	0.7	3.9	19/12	10.2	S	42.9	19/10	1017.1
44012	38.8N	074.6W	0731	24.1	24.0	0.7	4.0	19/13	10.5	S	46.2	19/11	1016.9
44013	42.4N	070.8W	0734	20.4	17.7	0.4	4.0	19/20	10.6	SW	44.9	19/19	1016.0
44014	36.6N	074.8W	0730	25.2	25.1	0.7	1.4	09/20	7.3	SW	17.7	09/16	1017.6
44025	40.3N	073.2W	0714	23.3	22.3	0.8	5.8	19/16	9.7	SW	44.3	19/16	1016.4
44026	36.0N	073.5W	0079	27.2	28.5	0.8	1.1	28/17	7.3	SW	14.4	31/09	1018.4
45001	48.1N	087.8W	0739	15.0	13.5				8.4	W	23.9	31/00	1017.4
45002	45.3N	086.4W	0739	20.2	20.6								1017.6
45003	45.3N	082.7W	0740	19.3	19.3				9.9	NW	24.1	31/10	1017.0
45004	47.5N	086.5W	0737	14.9	12.4	0.5	1.7	31/08	9.1	NW	17.2	31/07	1017.2
45005	41.7N	082.4W	0462	22.5	23.7	0.5	1.7	19/23	8.8	W	26.2	20/03	1015.5
45006	47.3N	089.9W	0737	18.4	17.7	0.5	2.4	31/07	8.3	W	25.5	31/05	1018.3
45007	42.8N	087.1W	0635	21.2	21.0	0.6	2.5	20/02	9.1	N	24.1	08/16	1018.3
45008	44.3N	082.4W	0735	20.4	20.7	0.7	2.5	31/15	9.0	NW	19.5	31/14	1017.6
46001	56.3N	148.3W	0736	11.1	11.2	2.0	4.1	25/18	12.6	W	28.0	13/19	1009.2
46002	42.5N	130.4W	0733	17.1	17.9	1.8	5.8	08/03	11.3	N	34.2	08/01	1019.0
46003	51.9N	155.9W	0733	10.9	10.8	2.3	5.7	14/13	14.7	W	32.8	14/07	1012.1
46005	46.1N	131.0W	0734	15.7	16.4	2.0	4.9	08/16	11.8	N	28.4	08/14	1017.9
46011	34.9N	120.9W	0740	14.7	15.0	1.5	3.0	10/08	11.4	NW	25.9	22/23	1016.6
46012	37.4N	122.7W	0738	14.3	14.6	1.2	3.2	10/20	7.8	NW	18.5	03/02	1016.4
46013	38.2N	123.3W	0737	13.4	12.9	1.4	3.3	10/04	10.7	NW	28.3	10/02	1016.7
46014	39.2N	124.0W	0740	13.5	14.0	1.5	3.7	10/14	10.6	NW	29.1	10/03	1017.1
46022	40.8N	124.5W	0735	13.1	13.2	1.6	4.1	11/03	9.5	N	22.9	07/21	1017.4
46023	34.3N	120.7W	0740	14.9	15.4	1.6	3.2	10/20	16.2	NW	27.1	31/05	1015.2
46025	33.8N	119.1W	0739	17.4	18.8	0.8	1.6	10/01	5.5	W	15.0	16/06	1014.9
46026	37.8N	122.7W	0740	13.6	14.2	1.0	2.6	10/05	9.3	W	22.3	26/07	1016.8
46027	41.8N	124.4W	0738	12.2	11.8	1.6	3.7	08/02	7.9	N	31.3	26/01	1016.9
46028	35.8N	121.9W	0738	14.8	14.9	1.6	3.4	10/08	12.5	NW	27.2	10/06	1017.0
46030	40.4N	124.5W	0732	12.5		1.5	3.4	10/12	11.6	N	24.7	06/22	1017.0
46040	44.8N	124.3W	0735	13.4	12.0	1.7	4.8	30/00	9.4	N	27.6	29/23	1017.4
46041	47.4N	124.5W	0731	13.5	13.7	1.6	4.8	08/01	8.8	NW	31.7	29/20	1016.9
46042	36.8N	122.4W	0737	14.4	15.1	1.4	3.3	10/22	10.8	NW	22.9	22/03	1016.3
46045	33.8N	118.5W	0737	17.9	19.0	0.7	1.5	10/06	4.9	SW	14.4	12/20	1015.0
51001	23.4N	162.3W	0739	26.2	27.0	2.0	4.3	09/09	14.3	E	24.2	09/06	1017.4
51002	17.2N	157.8W	0731	26.3		2.3	3.6	26/03	15.9	NE	25.4	26/13	1014.0
51003	19.3N	160.8W	0422	26.8	27.4	2.0	3.1	27/02	12.3	E	20.2	27/12	1014.8
51004	17.4N	152.5W	0738	26.0	26.4	2.2	4.3	07/05	15.2	NE	23.3	26/06	1013.7
91222	18.1N	145.8E	0571	28.7					7.4	SW	30.9	22/00	
91251	11.4N	162.4E	0723	28.1					8.3	SW	22.8	11/03	1008.7
91365	8.9N	165.8E	0733	27.8					6.3	E	24.2	21/03	1009.5
91377	6.1N	172.6E	0741	27.8					5.0	NE	20.9	09/20	1008.7
ALSN6	40.5N	073.8W	0736	23.2	22.2	0.7	2.7	09/21	13.2	SW	44.4	19/15	1017.0
BURL1	28.9N	089.4W	0738	27.9					7.6	SW	32.3	11/09	1016.5
BUSL1	27.9N	090.9W	0446	28.4									1017.9
BUZM3	41.4N	071.0W	0717	20.7					13.9	SW	67.0	19/17	1016.3
CARO3	43.3N	124.4W	0737	13.5					9.4	NE	35.1	08/00	1016.8
CHLV2	36.9N	075.7W	0732	25.1	25.1	0.7	3.1	19/08	11.3	S	47.1	19/05	1017.8
CLKN7	34.6N	076.5W	0700	26.4					8.4	SW	30.9	18/22	1017.5
CSBF1	29.7N	085.4W	0737	27.5					6.4	SW	21.6	14/13	1017.3
DBLN6	42.5N	079.4W	0033	23.5					12.4	SW	19.1	31/06	1014.1
DESW1	47.7N	124.5W	0736	13.2					10.9	W	50.7	29/19	1017.4
DISW3	47.1N	090.7W	0740	19.7					8.8	SW	26.9	31/11	1017.0
DPIA1	30.3N	088.1W	0739	27.7	29.7				7.2	NE	20.0	30/20	1017.1
DSLN7	35.2N	075.3W	0717	26.6	28.0	1.0	4.7	19/05	12.3	SW	84.9	19/03	1017.4
FBIS1	32.7N	079.9W	0734	27.1					8.1	SW	28.0	02/07	1017.3
FFIA2	57.3N	133.6W	0738	11.9					9.7	SE	30.4	25/17	1013.7
FPSN7	33.5N	077.6W	0734	27.2	27.8				10.6	SW	35.4	18/20	1017.6
FWYF1	25.6N	080.1W	0739	28.5	29.7				8.7	SE	23.2	29/23	1017.6
GBCL1	27.8N	093.1W	0734	28.0	30.1	0.4	1.3	16/17	7.5	S	27.9	31/17	1016.6
GDIL1	29.3N	090.0W	0736	28.0	30.5				6.5	S	28.1	10/15	1016.6
GLLN6	43.9N	076.5W	0737	21.2					10.9	SW	31.1	17/20	1015.7
IOSN3	43.0N	070.6W	0742	20.1					12.2	SW	47.4	19/21	1015.8
LKWF1	26.6N	080.0W	0741	28.1	29.5				7.9	SE	25.3	29/08	1017.6
MDRM1	44.0N	068.1W	0740	15.1					13.7	SW	52.0	20/02	1015.6
MISM1	43.8N	068.9W	0688	16.1					14.4	SW	55.7	20/01	1015.4
MLRF1	25.0N	080.4W	0708	28.7	30.2				7.6	SE	27.7	27/05	1017.2
MPCL1	29.4N	088.6W	0730	27.8	29.6	0.5	1.6	11/23	8.2	W	32.8	10/14	1017.1
NWPO3	44.6N	124.1W	0738	13.0					8.3	N	29.0	29/19	1017.3
ORKP2	7.6N	155.2E	0730	28.0					4.0	SW	20.8	13/16	1009.0
PTAC1	39.0N	123.7W	0737	13.0					8.9	N	27.6	11/21	1017.1
PTAT2	27.8N	097.1W	0555	28.5	30.1				12.5	SE	22.3	12/08	1014.9
PTGC1	34.6N	120.7W	0697	14.5					16.7	N	29.2	03/00	1015.9
ROAM4	47.9N	089.3W	0736	18.0	15.8				10.4	NE	28.1	01/12	1017.3
SANF1	24.5N	081.9W	0729	28.6	30.4				7.8	E	26.5	06/04	1017.0
SAUF1	29.9N	081.3W	0740	26.4	26.9				7.4	SW	21.0	01/10	1017.3
SBIO1	41.6N	082.8W	0733	22.9					8.1	NE	29.4	03/10	1017.0
SGNW3	43.8N	087.7W	0738	21.1					10.2	S	28.4	19/20	1017.9
SISW1	48.3N	122.9W	0739	13.0					8.9	W	39.0	29/23	1016.9
SPGF1	26.7N	079.0W	0738	28.5	30.2				4.8	SE	20.6	17/09	1017.4
SRST2	29.7N	094.1W	0722	27.8					7.3	S	20.9	03/15	1016.5
STDM4	47.2N	087.2W	0739	17.9					12.7	W	31.0	27/02	1018.5
SVLS1	32.0N	080.7W	0071	27.2		0.6	0.8	29/00	7.7	E	18.5	29/00	1018.3
TPLM2	38.9N	076.4W	0740	25.1	26.4				9.4	S	23.1	09/13	1017.2
TTIW1	48.4N	124.7W	0740	12.7					9.7	S	44.0	30/01	1017.6
VENF1	27.1N	082.5W	0431	27.6	31.2				7.1	E	22.8	14/17	1017.9
WPOW1	47.7N	122.4W	0739	15.9					5.2	NE	20.9	27/22	1015.9
SEPTEMBER		**1991**											
32302	18.0S	085.1W	0715	18.0	18.9	2.2	3.6	07/03	11.8	SE	24.5	05/07	1017.6
33301	56.3S	027.6W	0340	-6.8									1007.7
41001	34.9N	072.9W	0491	25.0	26.3	1.3	3.0	02/05	10.5	E	24.9	01/23	1019.1
41002	32.3N	075.2W	0719	26.0	27.1	1.6	4.0	02/18	10.7	E	26.3	26/10	1018.0
41008	30.7N	081.1W	0719	26.6	28.1	1.1	2.6	29/00	10.8	NE	23.5	29/02	1018.1
41009	28.5N	080.2W	1436	27.7	29.2	1.1	3.6	30/03	9.1	E	23.5	30/06	1017.3
41010	28.9N	078.5W	1177	27.3	28.4	1.2	3.6	30/19	8.5	NE	27.8	25/18	1017.1
41017	35.4N	075.1W	0711	24.6	26.6	1.4	3.3	20/19	12.1	N	29.3	26/01	1019.4

MEAN BUOY	MEAN LAT	MEAN LONG	SIG OBS	MAX SIG AIR TP (C)	MAX SIG SEA TP (C)	SCALAR MEAN WAVE HT (M)	PREV WAVE HT (M)	MAX WAVE HT (DA/HR)	MAX WIND SPEED (KNOTS)	MEAN WIND (DIR)	WIND (KTS)	WIND (DA/HR)	PRESS (MB)
42001	25.9N	089.7W	0719	27.8	29.0	0.8	2.6	29/09	10.6	E	22.9	29/05	1015.8
42002	25.9N	093.6W	0718	28.1	29.1	0.9	2.2	26/00	11.1	E	25.6	25/12	1015.9
42003	25.9N	085.9W	0717	27.8	28.9	0.7	2.0	29/15	9.1	E	22.0	01/05	1016.5
42007	30.1N	088.8W	0660	26.2	28.2				11.2	E	24.3	25/06	1017.8
42019	27.9N	095.0W	0714	27.5	28.9	1.0	2.8	21/03	11.4	E	25.8	20/04	1016.0
42020	27.0N	096.5W	0719	27.6	28.7	1.1	3.0	20/05	10.9	SE	27.6	20/15	1015.9
42025	24.9N	080.4W	0445	28.6	29.8	0.3	1.1	25/15					
44007	43.5N	070.1W	0720	14.4	14.3	0.6	2.0	23/17	11.1	SW	27.6	29/23	1019.0
44008	40.5N	069.4W	0709	17.5	17.9	1.2	4.2	25/23	12.1	N	27.6	25/18	1020.5
44009	38.5N	074.7W	0712	21.2	22.6	0.9	2.5	01/15	11.8	S	26.8	20/04	1020.0
44011	41.1N	066.6W	0607	15.7	15.1	1.5	4.0	26/08	10.8	N	24.3	20/16	1019.3
44012	38.8N	074.6W	0719	20.8	22.1	0.9	2.3	01/14	12.3	S	28.0	20/10	1019.9
44013	42.4N	070.8W	0713	16.3	16.4	0.4	1.3	01/08	11.5	SW	31.3	25/17	1019.6
44014	36.6N	074.8W	0710	22.5	23.1	1.1	3.4	20/16	10.1	NE	26.4	01/17	1019.8
44025	40.3N	073.2W	0710	20.0	20.9	0.9	2.8	25/16	11.2	SW	25.3	25/13	1019.7
44026	36.0N	073.5W	0717	24.6	27.4	1.4	4.7	25/14	11.8	N	30.9	25/16	1019.6
45001	48.1N	087.8W	0719	11.4	11.6	1.0	4.7	23/02	11.9	S	34.2	18/20	1015.4
45002	45.3N	086.4W	0720	15.1	17.1								1017.6
45003	45.3N	082.7W	0718	14.6	16.4	0.9	4.0	27/02	13.3	NW	33.2	27/00	1017.9
45004	47.5N	086.5W	0712	11.6	11.8	1.1	4.3	26/12	9.3	SE	21.5	17/04	1016.0
45006	47.3N	089.9W	0718	12.5	12.3	0.8	3.1	22/20	11.4	SW	29.7	16/20	1016.8
45007	42.8N	087.1W	0716	17.5	19.8	0.8	2.6	01/02	11.3	S	26.6	26/04	1019.5
45008	44.3N	082.4W	0719	15.8	18.5	1.0	3.4	27/00	11.1	S	26.0	30/17	1019.0
46001	56.3N	148.3W	0720	10.6	10.8	2.9	10.3	23/15	16.6	SW	34.0	16/07	1007.8
46002	42.5N	130.4W	0719	17.2	17.9	2.0	5.5	24/18	13.4	N	22.9	20/16	1021.3
46003	51.9N	155.9W	0719	10.7	10.5	3.2	13.2	23/08	17.1	SW	37.5	23/02	1005.2
46005	46.1N	131.0W	0719	15.9	16.8	1.8	4.5	25/07	9.7	N	19.4	20/11	1022.2
46011	34.9N	120.9W	0720	14.7	15.6	1.6	3.0	21/21	7.2	NW	20.0	01/21	1014.6
46012	37.4N	122.7W	0720	13.4	13.9	1.6	2.9	09/05	6.7	NW	17.7	25/19	1013.6
46013	38.2N	123.3W	0719	12.7	13.0	1.8	3.6	25/10	8.6	NW	25.9	09/01	1014.2
46014	39.2N	124.0W	0719	12.5	13.5	1.9	4.5	21/07	9.3	NW	27.7	09/02	1014.5
46022	40.8N	124.5W	0719	11.9	11.9	2.1	5.4	21/04	7.0	N	20.0	09/09	1015.2
46023	34.3N	120.7W	0719	14.9	15.6	1.7	4.5	25/20	11.6	NW	26.3	01/07	1013.6
46025	33.8N	119.1W	0717	16.7	18.1	0.8	1.4	01/04	5.2	W	12.4	20/23	1013.4
46026	37.8N	122.7W	0720	12.8	13.8	1.2	2.4	15/23	6.5	W	23.7	25/20	1014.4
46027	41.8N	124.4W	0717	11.5	11.3	2.0	4.7	21/01	8.4	N	34.4	20/23	1014.8
46028	35.8N	121.9W	0720	14.6	15.3	1.8	3.4	15/10	8.5	NW	23.7	01/06	1014.7
46030	40.4N	124.5W	0718	12.0		2.0	4.4	21/05	10.6	N	25.1	21/07	1014.7
46035	57.0N	177.7W	0069	6.7	7.6	3.2	7.6	30/04	19.9	SE	36.3	30/05	994.8
46040	44.8N	124.3W	0717	13.8	12.7	1.8	4.1	25/17	9.6	N	20.4	24/03	1017.9
46041	47.4N	124.5W	0720	13.5	13.6	1.6	3.8	20/12	6.7	NW	21.2	19/06	1019.3
46042	36.8N	122.4W	0717	13.8	15.5	1.8	3.9	16/09	8.2	NW	19.6	29/04	1014.5
46045	33.8N	118.5W	0717	17.3	18.4	0.6	1.1	01/07	4.4	SW	10.1	03/23	1013.4
51001	23.4N	162.3W	0720	26.4	27.4	1.9	3.4	15/01	11.0	E	21.5	30/07	1015.4
51002	17.2N	157.8W	0710	26.3		1.9	3.1	11/19	13.5	NE	21.6	06/06	1012.9
51003	19.3N	160.8W	0719	26.9	27.8	1.8	3.0	11/16	10.9	E	20.0	11/14	1013.2
51004	17.4N	152.5W	0718	26.1	26.6	2.1	3.4	25/09	14.0	E	21.3	04/04	1012.4
91222	18.1N	145.8E	0695	28.3					8.8	E	28.8	05/19	
91251	11.4N	162.4E	0710	28.0					9.7	E	23.8	24/16	1009.1
91353	6.2N	160.7E	0251	27.3					8.1	W	23.6	22/11	1009.4
91356	5.4N	163.0E	0710	26.9					7.3	SW	23.8	25/02	1009.3
91365	8.9N	165.8E	0713	27.9					6.4	E	21.3	24/10	1009.7
91377	6.1N	172.6E	0717	28.0					5.9	E	25.0	22/14	1008.8
ALSN6	40.5N	073.8W	0717	19.1	20.5	0.7	2.2	25/19	12.8	SW	31.9	25/12	1020.4
BURL1	28.9N	089.4W	0717	26.7					11.3	E	25.2	20/05	1017.1
BUZM3	41.4N	071.0W	0718	17.2					13.9	SW	34.4	25/15	1019.6
CARO3	43.3N	124.4W	0718	13.2					8.1	NE	23.9	21/23	1016.4
CHLV2	36.9N	075.7W	0718	22.3	23.6	1.0	2.7	20/08	12.4	NE	35.2	01/05	1020.5
CLKN7	34.6N	076.5W	0694	24.1					10.5	NE	26.0	01/23	1019.3
CSBF1	29.7N	085.4W	0717	26.2					6.0	NE	21.0	25/11	1017.8
DBLN6	42.5N	079.4W	0719	17.0					9.9	SE	33.2	26/18	1019.3
DESW1	47.7N	124.5W	0715	13.7					6.7	W	28.1	10/01	1019.8
DISW3	47.1N	090.7W	0716	13.3					11.9	SW	39.3	22/18	1015.7
DPIA1	30.3N	088.1W	0716	25.7	27.8				10.0	NE	24.3	20/06	1018.3
DSLN7	35.2N	075.3W	0687	24.7		1.3	3.4	02/01	14.5	NE	37.5	25/10	1019.7
FBIS1	32.7N	079.9W	0720	24.9					10.4	NE	28.4	02/20	1018.9
FFIA2	57.3N	133.6W	0719	10.5									
FPSN7	33.5N	077.6W	0719	25.7	27.6				9.2	SE	33.2	19/05	1017.9
FWYF1	25.6N	080.1W	0716	28.1	29.4				14.4	NE	33.7	26/00	1019.0
GBCL1	27.8N	093.1W	0713	27.0	29.3	0.9	2.3	29/14	9.1	E	27.9	30/18	1015.9
GDIL1	29.3N	090.0W	0718	26.4	28.2				11.7	E	27.8	29/13	1016.7
GLLN6	43.9N	076.5W	0719	16.5					9.7	E	24.3	25/05	1017.4
IOSN3	43.0N	070.6W	0717	15.7					12.2	S	35.9	26/22	1018.8
LKWF1	26.6N	080.0W	0719	27.5	29.5				12.3	SW	30.6	25/11	1019.7
LNEL1	28.2N	089.1W	0701	27.1					8.2	E	27.3	30/07	1016.1
MDRM1	44.0N	068.1W	0719	12.3									1017.8
MISM1	43.8N	068.9W	0664	13.4					13.5	SW	40.0	25/19	1018.9
MLRF1	25.0N	080.4W	0719	28.3	29.9				14.0	SW	40.2	25/18	1019.1
MPCL1	29.4N	088.6W	0715	26.5	28.6	0.9	3.2	30/13	7.9	E	23.9	09/07	1015.6
NWPO3	44.6N	124.1W	0719	13.3					9.0	E	28.7	05/19	1017.9
ORKP2	7.6N	155.2E	0714	27.5					7.4	N	24.0	10/01	1017.4
PILM4	48.2N	088.4W	0603	10.9					4.0	SW	23.1	03/22	1009.2
PTAC1	39.0N	123.7W	0718	11.9					16.1	NW	44.7	28/03	1014.6
PTAT2	27.8N	097.1W	0719	26.4	28.3				7.8	N	20.0	01/03	1014.5
PTGC1	34.6N	120.7W	0664	14.3					12.1	E	24.3	20/03	1015.9
ROAM4	47.9N	089.3W	0719	11.9	13.0				12.3	N	29.8	17/05	1014.0
SANF1	24.5N	081.9W	0568	28.2	29.9				15.4	SW	48.9	22/19	1017.1
SAUF1	29.9N	081.3W	0718	26.3	28.5				6.9	E	21.0	09/15	1015.9
SBIO1	41.6N	082.8W	0718	18.6					11.1	NE	30.7	29/02	1017.4
SGNW3	43.8N	087.7W	0717	17.3					10.2	NW	33.6	26/15	1019.1
SISW1	48.3N	122.9W	0718	12.9					10.7	S	27.0	18/19	1018.5
SMKF1	24.6N	081.2W	0168	28.1	29.8				4.5	W	16.0	06/03	1020.4
SPGF1	26.7N	079.0W	0718	27.9	29.5				10.3	E	22.0	27/08	1014.1
SRST2	29.7N	094.1W	0441	23.9					6.0	E	25.4	30/03	1015.8
STDM4	47.2N	087.2W	0716	12.5					8.7	NE	20.7	20/03	1019.0
SVLS1	32.0N	080.7W	0704	25.4		1.0	2.3	03/04	16.8	NW	44.0	18/21	1016.1
TPLM2	38.9N	076.4W	0719	21.0	23.8				13.5	NE	32.9	02/22	1018.7
TTIW1	48.4N	124.7W	0718	12.8					10.6	S	26.4	19/17	1020.2
VENF1	27.1N	082.5W	0296	25.7	29.3				9.2	NE	31.0	25/13	1020.4
WPOW1	47.7N	122.4W	0258	14.1					7.9	NE	19.6	22/21	1015.4

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